Flight and operation manual

Trixy Aviation

G 4-2

Flight and operation manual for Gyrocopter G 4-2

Individual gyrocopter data here!

This manual is to be carried along when operating the gyrocopter.
The extent and state of revision of this manual may be obtained from the index and the revision index.

The Gyrocopter ***G 4-2*** may only be operated in accordance with the instructions and within the operating limits included in this manual.

This manual does not substitute a theoretical or practical instruction to operate this gyrocopter.

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REVISIONS TO THE FLIGHT OPERATIONS MANUAL

No.	Description	Page	Date	Signature

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1 GENERAL

1.1 Introduction

This manual contains information which is necessary to operate the gyrocopter efficiently and safely according to German regulations, as well as information from the manufacturer.
The maintenance manual contains all the necessary information, instructions and documents required for proper maintenance.

To fly this gyrocopter, a pilot´s license according to the rules and regulations of the country it is to be flown in is required. Before flight, it is important that the pilot be instructed about the features and characteristics of the gyrocopter during a thorough familiarization in an authorized flight school.
The registration of the gyrocopter is obligatory in almost all countries. It is the responsibility of the operator to get and follow the valid rules in the country it is intended to fly in.
Further laws, like the acquisition of third-party liability insurance are to be observed as well.

It is obligatory to read the entire manual and all documents provided by the manufacturer to get accustomed with every detail of the gyrocopter and the installed equipment.

1.2 Registration and certification basis

The statutory basis for the operation of an ultra-light gyrocopter (ULG) is regulated in air traffic laws. Details are to be obtained from associated documents. All rules and regulations contained in these documents must be obeyed.
The ***G 4-2*** is constructed, manufactured and tested according to the „construction regulations for ultra-light gyrocopters“ (BUT 2001) and Nfl II 13/09 dated 12.02.2009 and is registered under the identification number 61218 by the responsible German authority (DAeC).

1.3 Performance data and operating procedure

The performance data and operating procedures mentioned in this manual have been determined during the type certification process of this gyrocopter.

1.4 Warnings and precautions

The following definitions are used for warnings, precautions and notes in this manual:

Warning: means that the disregard of the corresponding procedure leads to an immediate or major reduction of flight safety.

Attention: means that the disregard of the corresponding procedure leads to a reduction of flight safety over time.

Note: attends to special issues which are not in direct relation to flight safety, but are important or unusual.

Precautionary measures:

It is highly recommended:

- To regularly read the flight safety briefs in publications [e.g. Aviation magazines, aviators pocket calendar, notifications for airmen, notifications of the official authorities, publications from Trixy Aviation, etc.].
- Not to conduct flights during high turbulences as this may lead to damage to the main structure as well as uncontrollable flight conditions.
- To operate the aircraft with care on uneven ground and to maintain it accordingly.
- To regularly conduct the checks described in section 3 “Operating Procedures” before to every flight.

Warning: This manual is not to be considered as a proper theoretical or practical instruction for the operation of this gyrocopter!

Warning: The disregard of the instructions given in this manual may have fatal or life threatening consequences!

Warning: Any manouver which causes the sensation of being weightless or flyin in negatve G´s may lead to a loss of maneuverability paired with a massive loss of rotor RPM. To keep the rotor under load at all times it is not permitted to suddenly push the stick forward during cruise or after pulling up.

Warning: Refrain from flying during weather with tendency to thunderstorms. Thunderstorms may develop surprisingly quickly and bring the risk of heavy rain, hail, extreme turbulences with strong vertical air movements as well as lightning strikes with them. A lightning strike may damage the rotor bearing due to the high currents. The gyrocopter must go through a thorough inspection by an authorized aeronautical maintenance shop in case it was hit by a lightning strike.

Warning: Side slipping may only be executed with proper training and within safe boundaries. Initiation and stabilization of the side slip must be conducted with careful pedal input. The indicated airspeed during side slip is not correct! No abrupt stickmovements are to be made in the direction of movement. Extreme slipping may lead to an uncontrollable flight condition.

Warning: Aerobatics and turns with greater angles than 60° are not permitted.

Warning: For the purpose of fire prevention smoking is not permitted aboard the aircraft!

Attention: Disregard of the instructions contained in this manual may lead to damage to the gyrocopter.

Note: Disregard of the instructions contained int his manual will lead to loss of warranty.

Two models of the series G 4-2 are available: Liberty and Princess.

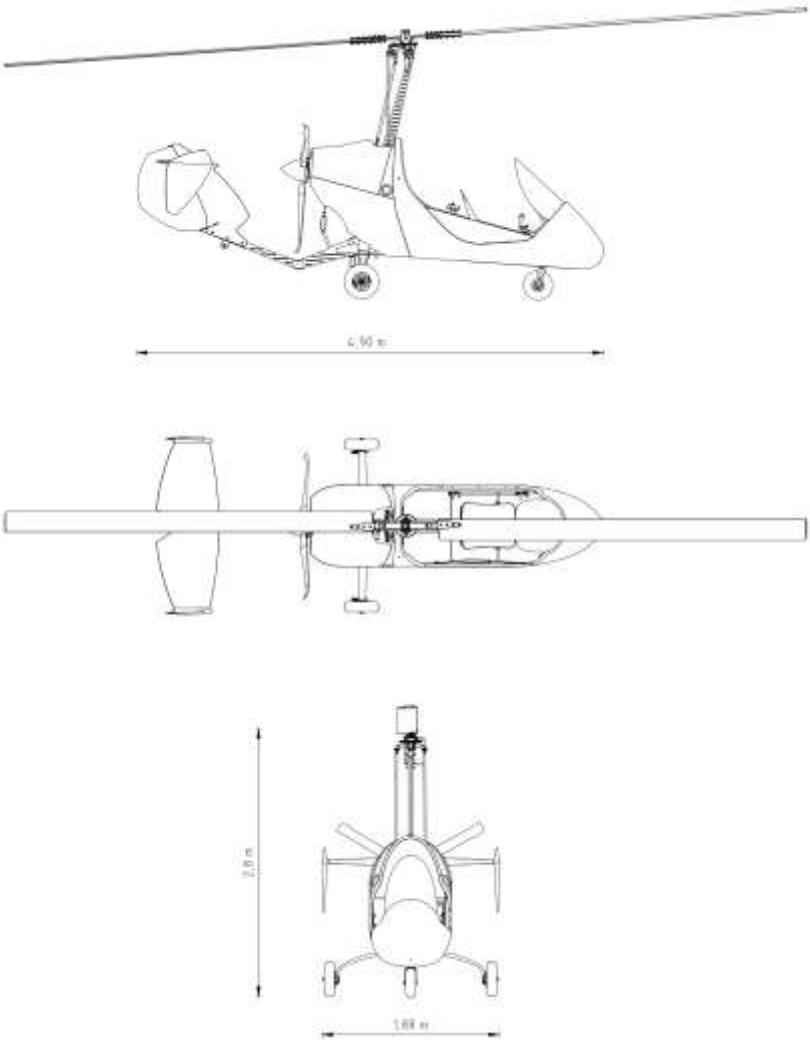
Liberty is an entry-level model, which is basically designed to operate with an open cabin. This model, however, can be converted with an optional kit into a gyrocopter to fly with a closed cabin..

Princess is the top model, which is basically designed to operate with a closed cabin. This model, however, can be converted with an optional kit into a gyrocopter to fly with an open cabin.

1.5 Side view, top view and front view (2 models)

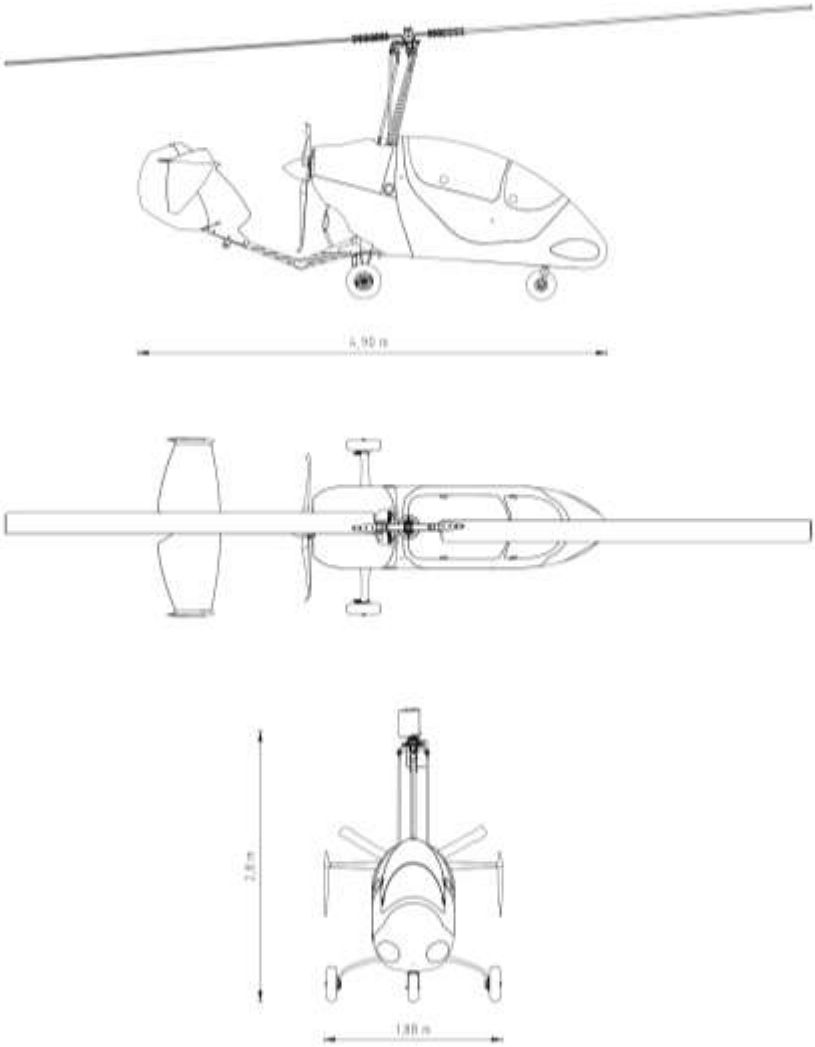
Note: The three sides view is not drawn to scale!

The model ***Liberty***



Note: The three sides view is not drawn to scale!

The model ***Princess***



1.6 Description

- Gyrocopter with nose wheel steering
- Stainless steel frame welded in gas-shielded process
- Two seats in tandem configuration inside an open cabin (***Liberty***) or inside an enclosed cabin made of carbon fiber composite with removable hard top (***Princess***).
- Main undercarriage strut, equipped with hydraulic brakes
- Rotor made of extruded aluminum profile.
- Rotor head steering with push rods for 2 heads: tilt head or swash-plate head.
- Rudder steering with steel wires.
- Rudder and stabilizers made from CFC.

1.7 Technical data

Length	4.90 m
Width:	1.85 m
Heigh:	2.80 m
Empty weight:	265 - 310 kg
Load capacity:	190 - 280 kg
Max. Take-off weight:	500 - 560 kg (as motorized)
Tank capacity:	34 l / 68 l (as equipped)

1.8 Rotor

Air foil:	NACA 8H12
Manufacturer:	Averso Aviation
Rotor diameter:	8.4 m / 8.6 m (as equipped)
Rotor surface area:	55.4 m² / 58.0 m²
Specific load of rotor surface area:	10.1 kg/m² / 9.65 kg/m²
Recommended overhaul/exchange:	500 h / 1000 h

1.9 Propeller (3 types)

Type:	3B-FC Windspoon left
Manufacturer:	DUC *www.duc-helices.com*
No. of blades:	3
Diameter:	173 cm
Blade material	Fiber-reinforced plastic
Pitch adjustment:	Ground adjustable
Recommended overhaul/exchange:	800 h

Type:	CL3-V-70-(IP)-R2
Manufacturer:	Neuform www.neuform-composites.de
No. of blades:	3
Diameter:	170 cm
Blade material	Fiber-reinforced plastic
Pitch adjustment:	Adjustable in flight
Recommended overhaul:	1000 h

Type:	TXL3-V-70-R2
Manufacturer:	Neuform www.neuform-composites.de
No. of blades:	3
Diameter:	170 cm
Blade material	Fiber-reinforced plastic
Pitch adjustment:	Adjustable in flight
Recommended overhaul:	1000 h

1.10 Power plant (3 types)

Type:	912 ULS
Manufacturer:	Rotax *www.rotax-aircraft-engines.com*
Recommended overhaul:	2000 h
Performance / RPM:	100 HP / 5800 RPM
Continuous output:	95 HP / 5500 RPM
Torque / RPM:	107 Nm / 5500 RPM
Nr. of cylinders / type:	4 / opposed
Displacement:	1352 cm^3
Cooling system:	Liquid/Air cooling
Lubrication:	Oil in separate tank
Fuel:	Regular unleaded (min. 95 octane)
Alternative fuel:	Aviation fuel AVGAS 100 LL
Fuel supply:	1 mechanic Pump (optional: 1 Electric booster pump)
Fuel / air mixture:	2 CD-carburetors
Consumption at performance %:	16.5 l/h at 75%
Ignition:	Dual solid-state magnetos
Propeller drive:	Via integrated transmission
Exhaust system:	Steel exhaust system +2 mufflers

Starter:	Electric (12V 0.6 kW)
Generator:	Alternating current with external Rectifier (12V 20A DC)
Type:	914 UL
Manufacturer:	Rotax *www.rotax-aircraft-engines.com*
Recommended overhaul:	2000 h
Performance / RPM:	115 HP / 5800 RPM
Continuous output:	100 HP / 5500 RPM
Torque / RPM:	128 Nm / 5500 RPM
Nr. of cylinders / type:	4 / opposed
Displacement:	1211 cm³
Cooling system:	Liquid/Air cooling
Lubrication:	Oil in separate tank
Fuel:	Regular unleaded (min. 95 octane)
Alternative fuel:	Aviation fuel AVGAS 100 LL
Fuel supply:	1 electric Pump (optional: 2 electric pump2)
Fuel / air mixture:	2 CD-carburetors
Consumption at performance %:	20.4 l/h at 75%
Ignition:	Dual solid-state magnetos
Propeller drive:	Via integrated transmission
Exhaust system:	Steel exhaust system +2 mufflers
Starter:	Electric (12V 0.6 kW)
Generator:	Alternating current with external Rectifier (12V 20A DC)
Type:	912 TI
Manufacturer:	Trixy Aviation *www.trixyaviation.com*
Recommended overhaul:	2000 h
Performance / RPM:	130 HP / 5800 RPM
Continuous output:	113 HP / 5500 RPM
Torque / RPM:	145 Nm / 5500 RPM
Nr. of cylinders / type:	4 / opposed
Displacement:	1211 cm³
Cooling system:	Liquid/Air cooling
Lubrication:	Oil in separate tank
Fuel:	Regular unleaded (min. 95 octane)

Alternative fuel:	Aviation fuel AVGAS 100 LL
Fuel supply:	1 electric Pump (optional: 2 electric pump2)
Fuel / air mixture:	2 CD-carburetors
Consumption at performance %:	23.0 l/h at 75%
Ignition:	Dual solid-state magnetos
Propeller drive:	Via integrated transmission
Exhaust system:	Steel exhaust system +2 mufflers
Starter:	Electric (12V 0.6 kW)
Generator:	Alternating current with external Rectifier (12V 20A DC)

1.11 Abbreviations and Terminology

Velocities:

IAS	Indicated Airspeed: All data in this manual refers to indicated airspeed and does not consider instrument fluctuations
CAS	Calibrated Airspeed: Indicated airspeed corrected to the value of variation related to the construction.
TAS	True Airspeed: True speed of the gyrocopter in smooth air and corrected for air density.
V_{ne}	V never exceed: Highest permissible IAS, which must never be exceeded.
V_{S0}	Minimum horizontal-flight-speed, IAS
V_x	Speed for steepest possible angle of ascent (best ascent angle).
V_y	Speed for best ascent (best ascent rate).
V_A	Maneuvering speed.
V_{Cruise}	Maximum cruising speed

Atmosphäre:

ISA	International Standard Atmosphere.
OAT	Outside Air Temperature.
PA	Pressure Altitude.
DA	Density Altitude.

Weight and Center of Gravity:

MTOW	Max. take-off weight.
Empty Wt.	Empty weight, weight of the empty gyrocopter with full oil container, unusable fuel and engine coolant.
CG	Center of Gravity.
CGRP	Reference point for center of gravity (datum)

1 OPERATING LIMITATIONS

2.1 Introduction

Section 2 contains the operating limits and indicating labels which are necessary for safe operation of the gyrocopter including the power plant, standard systems and equipment.

It contains the tested operating limits which have been recorded during testing, as well as those, which were mathematically calculated and tested in practical tests.

The gyrocopter ***G 4-2*** is not designed for aerobatic flight. Turns are limited to 60° angle.

Flights under icing conditions (i. a. high humidity and air temperature lower than +10° C) are not permitted.

It is not allowed to fly during extreme gusty winds or in wind velocities exceeding 72 km/h (= 20 m/s = 40 knots).

All the safe weights have been tested in trials according to the "construction regulations for ultra-light gyrocopters" during the type certification process. However, this does not mean that higher forces are not to be expected, especially when operating the gyrocopter on very uneven terrain. For this reason it is especially important to maintain it with great care and to exchange the parts that were exposed to extreme and/or unusual loads.

Warning: To operate the gyrocopter it is required that the pilot has undergone a professional training and is in possession of a proper pilot's license besides the familiarization process on this specific model.

Note: This gyrocopter does not comply to the rules and regulations of the International Civil Aviation Organization (ICAO). For this reason it is not permissible to participate in international air traffic unless a special permit is obtained or interstate agreements are in existence.

2.2 Flight velocities

The data printed here are indicated air speeds (IAS) and refer to the original mount location of the Pitot-tube, in the center of the fuselage`s nose.

V_{ne}	167 km/h maximum permissible speed
V_A	100 km/h maneuver speed
V_x	90 km/h speed of best angle of climb
V_y	100 km/h speed of best ascent rate
V_{Crusie}	160 km/h maximum cruise speed
$V_{Approach}$	90 km/h minimum recommended approach speed
V_{S0}	40 km/h minimum speed
$V_{cross\ wind}$	35 km/h maximum permissible crosswind during take-off

Warning: The maximum permissible speed (**V_{ne}**) may never be exeeded! The maximum speed in gusty or turbulent air (**V_A**) must be adhered to when flying through such conditions!

Warning: Harsh maneuvers in direction of the lateral- or longitudinal-axis through extreme movement of the control stick is prohibited!

Warning: The gyrocopter may never be flown with less than **+ 0.3 G**. During flight with low G forces special attention must be payed to the rotor RPM. A decrease of rotor RPM must be encountered by immediately stopping the „low-G“flight!

Warning: The rotorsystem must be burdened adequately throughout the entire flight. Any maneuvers causing a sensation of complete or partial weightlessness are not permited and are to be avoided!

2.3 Engine limitations

Rotax 912 ULS

Take-off output:	100 HP / 5800 RPM
Recommended continuous output:	95 HP / 5500 RPM
Max. Allowed cont. power setting:	5500 RPM
Max. Allowed take-off RPM:	5800 RPM
Cylinder head temperature:	max. 135° C
Oil temperature:	min. 50° C / max. 130° C
Fuel quality:	EN228 Super (min 95 octane) or EN228 Super plus (min 98 octane)
Alternative fuel (*):	AVGAS 100 LL (ASTM D910)
Oil type (*):	SAE 10W-40, API SG or higher (E.g. Oil Shell Advance VSX4)

Rotax 914 UL

Take-off output:	115 HP / 5800 RPM
Recommended continuous output:	100 HP / 5500 RPM
Max. Allowed cont. power setting:	5500 RPM
Max. Allowed take-off RPM:	5800 RPM
Cylinder head temperature:	max. 135° C
Oil temperature:	min. 50° C / max. 130° C
Fuel quality:	EN228 Super (min 95 octane) or EN228 Super plus (min 98 octane)
Alternative fuel (*):	AVGAS 100 LL (ASTM D910)
Oil type (*):	SAE 10W-40, API SG or higher (E.g. Oil Shell Advance VSX4)

Rotax 912 TI

Take-off output:	130 HP / 5800 RPM
Recommended continuous output:	113 HP / 5500 RPM
Max. Allowed cont. power setting:	5500 RPM
Max. Allowed take-off RPM:	5800 RPM
Cylinder head temperature:	max. 135° C
Oil temperature:	min. 50° C / max. 130° C
Fuel quality:	EN228 Super (min 95 octane) or EN228 Super plus (min 98 octane)
Alternative fuel (*):	AVGAS 100 LL (ASTM D910)
Oil type (*):	SAE 10W-40, API SG or higher (E.g. Oil Shell Advance VSX4)

(*) = Also see engine manuals

Further data can be found in the provided engine manuals.

Warning: The engine may not be started without the propeller in place or it could suffer damage due to over-revving!

Warning: With the propeller in place, the engine RPM may never pass the maximum permissible value or severe damage could be the consequence!

2.4 Weights

The maximum take-off weight (MTOW) with Rotax 912 ULS is 500 kg.
The maximum take-off weight (MTOW) with Rotax 914 UL is 530 kg.
The maximum take-off weight (MTOW) with Trixy 912 TI is 560 kg.
This weight includes empty weight of the gyrocopter, pilot's weight, fuel and luggage.
The pay load = MTOW minus the empty weight of the aircraft including all optional equipment.
If additional equipment is installed in the gyrocopter which adds to the empty weight, the pay load will be reduces. It is the pilot's responsibility to assure that the MTOW is not exceeded.
The maximum permissible range for the center of gravity must not be exceeded.
The center of gravity range and the empty weight are to be found in section 5 of this manual as well as in the gyrocopter registration documents.
The reference point for the CG (datum) is the leading edge of the Pitot-tube while the cabin floor is horizontal.

Pilot's weight

The pilot's weight is extremely important for safe flight:

Max. Pilot's weight: 125 kg

Min. Pilot's weight: 65 kg

Pilots weighing less than 65 kg must carry a belt with weights around their waste.
All weight combinations of pilot, co-pilot, fuel and luggage are only permissible under consideration of the MTOW.

Luggage weight

The ***G 4-2*** is equipped with 2 luggage compartments under the passenger seat. Only soft luggage may be stowed in these compartments. The luggage compartments may not be laden beyond 5 kg each (10 kg total). This must be considered in the MTOW of 450 kg.

Warning: Stowing hard and/or sharp-edged luggage in the compartments is not permitted. Doing so may cause damage to the gyrocopter and could lead to a crash during turbulent conditions.

2.5 Center of gravity

The center of gravity and the reference point can be found in section 5 of this manual and in the gyrocopter registration documents.

2.6 Permissible maneuvers

UL-gyrocopters are constructed to withstand and fly maneuvers with more than + 0.3 G and less than +3 G.

Warning: All aerobatic manouvers are PROHIBITED!
Flying a turn with more than a 60° angle is PROHIBITED!
All manouvers which may lead to a partially or completely unburdened state are PROHIBITED!
Slipping is only permitted if the pilot is trained accordingly and is to be performed with care. Extreme slipping is PROHIBITED!

2.7 G-forces

Max. Permissible G-forces:	+3.0 G
Min. continuous permissible G-forces:	+1.0 G
Min. permissible G-forces:	+0.3 G

Negative G-forces are not permitted.

2.8 Minimum crew

One pilot in the front seat. The pilot must weigh 65 kg – 125 kg. Pilots weighing less than 65 kg must wear waste harness with ballast weight.

2.9 Operating modes

It is only permitted to operate the gyrocopter during day time in VFR conditions unless otherwise permitted by the local authorities.

2.10 Fuel

Total tank content:	34 l (optional 68 l with auxiliary tank)
Flyable content:	32.5 l (65 l with auxiliary tank)
Fuel quality:	EN 228 Super (min 95 Octane) EN 228 Super plus (min 98 Octane)
Alternatively:	AVGAS 100 LL (ASTM D910)

Warning: A heavy pilot must consider a higher amount of unflyable fuel because of the aircraft´s attitude. Low nose attitude may cause the engine to fail during certain maneuvers due to a lack of fuel flow.

Warning: If a landing must be made with low fuel remaining, it must be done with a low sink rate and a raised nose.

The engine manufacturer recommends unleaded gasoline (95 Octane) as fuel. AVGAS 100LL can also be used.
Due to a lower risk of vapor bubble build-up during very hot conditions and freezing during very low temperatures, AVGAS 100LL should be preferred during these times.
Every time after fueling, the fuel must be checked for no water content. Open the drain under the aircraft and take a sample of fuel to check it for no water content. In case no layering between water and fuel can be seen, it is to be checked whether only water or fuel is contained in the tank. If in doubt, draining should be continued until only pure fuel is in the tank (s) of the gyrocopter.

In case of prolonged operation (more than 30%) with AVGAS 100LL the condition of the sparkplugs must be checked every 25 hours due to the danger of lead buildup on the electrodes. The engine manufacturer also demands an additional check of the power plant every 50 hours in case of prolonged operation with this type of fuel. When fueling, it is to be made certain that only clean fuel, free of water be supplied. In case of doubts a funnel with an integrated filter should be used when fueling.

2.11 Operation fluids

Engine oil:	SAE 10W-40 oil quality API SG (E.g. Shell Advance Ultra 4) or higher
Brake fluid:	DOT 4 or BERINGER-Brake fluid

The instructions of the engine manufacturer are to be checked in the engine service manual. When using AVGAS as a main fuel, alternative engine oil according to the engine manuals must be used. For further information please check the engine manuals.

2.12 Operation limit labels

To be found left of the pilot's seat, in the cockpit or the pilot´s field of vision:

Only daytime VFR flights are permitted!

Aerobatics prohibited!

Low-G maneuvers prohibited!

Flight under icing conditions prohibited!

MTOW _____ kg

Empty Weight: _____

Max. Pay Load: _____

For further information see the manual!

3 NORMAL OPERATION

3.1 Introduction

Section 3 of this manual contains check lists and operating instructions for standard operations.

Warning: It is recommended to read the operation manuals from the engine and propeller manufacturers and to follow the instructions contained in those manuals. These informations complete the statements made to engine and propeller in this manual.

Note: In case of misuse or mishandling all warranties are void!

3.2 Periodic inspections

Almost all technical faults can be found and recognized through a thorough pre-flight inspection. For this reason, proper care should be taken to be able to avoid crash risks.

Attention: Both magnetos must be in OFF position and the gyrocopter must be secured against rolling during the inspection.

Power plant

- ✓ Check for fluid leaks (oil, coolant and fuel)
- ✓ Check oil level according to engine manual
- ✓ Check lubrication- and fuel system hoses for leakages
- ✓ Check electrical connections, sparkplug plugs, gas- and choke pull cables for proper condition.
- ✓ Crank the engine by hand (watch proper direction) to check for any unusual sounds, difficult movement and good compression.

Propeller

- ✓ Check propeller blades for cleanliness and damages
- ✓ Propeller blades are properly attached to the hub
- ✓ Spinner is properly attached to the hub
- ✓ Propeller is properly attached to the engine flange

Rotor

- ✓ Check Titer-bolt and safety splint pin

- ✓ All hub bolts are in place
- ✓ No deformation or surface damage
- ✓ Check wear of the rotor-brake pad

Rotorhead

- ✓ Check pre-rotator gears for wear
- ✓ Check main bearing for ease of motion
- ✓ Bendix-gear axes lubricated and free rotatable
- ✓ Check safety splint pins for proper seating

Rotor control rod

- ✓ Check push rods for proper attachment and wear
- ✓ Check bell crank for ease of motion and wear
- ✓ Control stick (also in back if available) is freely movable and has no play in all directions

Rudder

- ✓ Check pedals and cables for free movement and cables for abrasions
- ✓ Rudder and stabilizers properly mounted and not damaged
- ✓ Check end stops with relieved nose wheel
- ✓ Rudder hinges secure and without play

Frame

- ✓ Check all frame parts for deformations or cracks
- ✓ Check seat shell and holding fixture for proper seating

Undercarriage

- ✓ Check tire pressures and condition
- ✓ Check mounts and proper seating of main undercarriage

Nose wheel

- ✓ Lift nose wheel and check for freedom of movement
- ✓ Check welds, linkage and wheel fork for proper seating

Wheel brakes

- ✓ Check for function
- ✓ Check brake fluid level
- ✓ Check wear of brake pads

Pre-rotator

- ✓ Check pulley and belt for wear
- ✓ As soon as a gentle engagement of the pre rotating mechanism is not possible apply silicon spray to the inside of the belt
- ✓ Driveshaft is straight and without play
- ✓ Check the gear box for mounts and rotation without play
- ✓ Check clutch lever and the wire system for play

Bowden cable

- ✓ Gas, choke and rudder cables move freely and a slightly wetted with oil to prevent freezing

3.3 Pre-flight check

01	Both Magneto switches	off
02	Master switch	off
03	Nose wheel tire pressure visual inspection	OK
04	Bolts of the front steering stick	OK
05	Bolts of the back steering stick (optional)	OK
06	Canopy hinges and locking system	OK
07	Wheel / brake right bolts and mounts	OK
08	Tire pressure right visual inspection	OK
09	Mounts of the main gear strut right	OK
10	Open engine compartment look for damage	check
11	Engine cowling and hinges right side	check
12	Engine compartment locks	check
13	Tank, filler cap and hoses right	tight
14	Oil level	check
15	Engine hoses and wiring right side	tight
16	sparkplug caps right side	tight
17	Coolant level	check
18	Pre-rotator drive	OK
19	Fuel free from water	check
20	Fuel level visual inspection	noted
21	Frame welds in engine compartment	OK
22	Propeller undamaged / tight / blade position	check
23	Rudder cable tension	OK
24	Empennage / rudder / cable connections	tight/OK
25	Engine cowling and hinges left side	check
26	Engine hoses and wiring left side	tight
27	Sparkplug caps left side	tight
28	Exhaust system	tight
30	Engine cowling closed properly	OK
31	Wheel / brake left bolts and mounts	OK
32	Tire pressure left visual inspection	OK
33	Mounts of the main gear strut left	OK
34	Vertical rotor control rods secure with no play	OK
35	Rotor head moves freely / bolts	tight
36	Head main bolts are secured	check
37	Rotor blades clean and undamaged	check
38	Cabin glass clean and undamaged	OK
39	Windshield clean and undamaged	OK

39	Static air intake free and clean	OK
40	Windshield undamaged and clean	OK
41	Landing lights undamaged and clean	OK
42	Pitot-tube free and clean	check
43	Rotor free	OK
44	Throttle rods and wire free moving	OK
45	Wheel brake function	check
46	Luggage (only soft objects)	stowed
47	Luggage compartments correctly loaded	check
48	Canopy glass (optional) tightly installed	check
49	Rear seat belts fastened and locked	OK
50	No free objects lying on the floor	check
51	Key is removed from the canopy lock	check
52	Main electric switch	ON
53	Landing and Navigation lights	check
54	Switches for lights fan and cabin heating	OFF
55	Auxiliary fuel pump (Option) Function	check
56	Auxiliary fuel pump switch and main switch	OFF
57	MTOW	check
58	Board documents and flight charts on board	present

Warning: This manual does not replace a theoretical or practical training to operate this gyrocopter.
Disregard to this may result in death or severe injury!
It is the responsibility of the pilot to cunduct a visual inspection prior to every flight. The necessary expertise to do this is aquired during the pilot training course (special details will be instructed during the familiarization with this gyrocopter).

3.4 Before engine start check

- ✓ Passenger briefing
- ✓ Passenger secured
- ✓ Loose objects aboard secured
- ✓ Rotor free (rotor securing bag removed)
- ✓ Stick moves freely in all directions
- ✓ Embark and fasten seatbelt
- ✓ Parking break set
- ✓ Wind checked
- ✓ Propeller area clear
- ✓ Main instrument (glass cockpit) turned on
- ✓ Set pilot's name, QNH and amount of fuel

3.5 Operating procedures with external power source

When charging the battery with an external charger, it is recommended to use one for iron phosphate. While charging, the battery must be disconnected from the on-board circuit and connected to the charger with the correct polarity. The circuit voltage is 12V. The battery is to be exchanged, if the voltage drops under 8 V.

3.6 Start-up

When the engine is started, a person who is authorized and trained to operate the gyrocopter must be in the pilot's seat. The function of the controls in the cockpit can be found in section 7 of this book.

Warning: This manual does not replace a theoretical or practical training to operate this gyrocopter.
Disregard to this may result in death or severe injury! Only trained and authorized persons (e.g. flight technician) and pilots may start the engine!

Warning: The propeller area must be clear with some distance! There is a high risk of severe injury and death!

Engine start check:

- ✓ Parking break set OK
- ✓ Throttle idle
- ✓ Master switch ON
- ✓ Alternator indicator illuminated
- ✓ Choke for cold engine pulled up
- ✓ Choke for warm engine pushed down
- ✓ Propeller area clear
- ✓ Ignition switches (Mag 1 and Mag 2) ON
- ✓ Lift starter switch until engine fires up (max. 20 seconds!).
- ✓ Avionic switch right after engine starts ON
- ✓ Check oil pressure immediately after start (min. 1.5 bar).
- ✓ Choke (required?) push down after short warm-up time.
- ✓ Let engine run at 1800 RPM for 2 minutes, then at 2500 RPM until oil temperature reaches 50°C.

Warning: It is obligatory to follow the instructions for the propeller (see section 3.22 in this book and the proprller manual provided by the manufacturer)!

Note: To start the engine when it is cold, the choke must be fully pulled up and the throttle in the idle position or the choke is rendered useless.
If the engine does not fire-up, wait 20 seconds before attempting to start again so the battery and starter motor do not overheat. The engine temperature should be checked and the use of the choke reconsidered.

3.7 Before taxi check

- ✓ Close and lock canopy.
- ✓ Adjust ventilation as desired.
- ✓ Cabin heater as desired (optional).
- ✓ Auxiliary fuel pump (optional) check for function and then off.
- ✓ Check fuel level.
- ✓ Adjust altimeter.
- ✓ Turn on and adjust radio (optional).
- ✓ Turn on and adjust transponder (optional).
- ✓ Check if ELT is functioning (optional).
- ✓ Landing lights and optional Nav/Strobes as desired.
- ✓ Check compass heading.

Warning: Turns at slow speeds only and with caution due to danger of tipping!

Warning: Caution when taxying onto uneven ground otherwise severe damage to landing gear and rotor system may occur!

3.8 Check during taxying

- ✓ Adjust trim nose heavy to keep the stick in a forward position
- ✓ Surrounding area is free
- ✓ Request permission to taxi (if necessary)
- ✓ Taxi at a brisk walking speed
- ✓ Do not push pedals unless the aircraft is moving
- ✓ Activate breaks (check for effectiveness)
- ✓ Continue taxiing at low speed and monitor engine instruments
- ✓ Watch rotor blades strait forward while taxiing
- ✓ Taxi slowly into turns due to risk of tipping

3.9 Preparation for take-off and pre-rotation

Warning: Take-off direction should be against the wind if possible!
The maximum crosswind during take-off is 35 km/h!
Insure the rotor control stick position while pre-rotation otherwise severe damage may be caused!

Attention: During pre-rotation the control stick must be held in the forward center position until a minimum of 180 RPM has ben reached otherwise a collision between the rotor and empennage may occur.

- ✓ Hold stick in front, center position
- ✓ Hold break engaged
- ✓ Check engine instruments
- ✓ Check ignition circuits at 3000 RPM. The speed drop should be no more than 150 RPM when turning off one of the circuits.
- ✓ Throttle back to idle position.
- ✓ Request take-off permission (if required)
- ✓ Line up against the wind on the runway and engage the brakes
- ✓ Rotor area free?
- ✓ Adjust trim nose heavy to keep the stick in a forward position
- ✓ Hold the stick in the forward, middle position
- ✓ Quickly but gently push pre-rotator pedal forward with foot
- ✓ Maintain engine RPM at 2500-3000 RPM with the throttle lever
- ✓ Build up rotor speed of 200-220 RPM with the throttle and pedal
- ✓ Release the pre-rotator pedal and put feet on both rudder pedals
- ✓ Pull the rotor control stick back towards body all the way
- ✓ In case of crosswind turn rotor sideways as required
- ✓ Release brake
- ✓ Push throttle forward until engine reaches maximum power
- ✓ Adjust trim as required

Warning: Before accelerating, make sure the stick is pulled back all the way towards your body. It is life threatening to start acceleration with the stick forward.

3.10 Take-off

- ✓ Accelerate with full throttle
- ✓ Hold direction using rudder pedals
- ✓ Briefly check engine instruments
- ✓ Climb speed is 90-110 km/h IAS
- ✓ As soon as nose wheel leaves the ground push stick forward gently and take-off flat on the main gear.

3.11 Climb

- ✓ Adjust trim pressure for comfortable control stick
- ✓ Check engine instruments
- ✓ Landing lights?
- ✓ Minimum safe altitude reached?
- ✓ Engine power as required (also see engine manual)

3.12 Cruise

- ✓ Adjust trim pressure as desired for confortable cruise
- ✓ Check engine instruments
- ✓ Auxiliary fuel pump (optional) off unless needed
- ✓ Adjust engine to cruising speed 80-160 km/h at 4000-5500 RPM
- ✓ Periodically check engine instruments and fuel

The permissible maximum speed (V_{NE}) is 167 km/h may never be exceeded. During strong turbulences the maneuver speed V_A (100 km/h) must be adhered to.

Attention: The fuel required during cruise depends on the weather conditions, speed and load. The indicated fuel consumption in the glass cockpit is a calculated value based on engine RPM and it should not to be used as a true value for remaining fuel calculations. Consider possible fuel leaks which the instrument is not detecting.

3.13 Descent

- ✓ Use engine throttle to maintain 100 km/h (110 km/h in case of rain or turbulence)
- ✓ Adjust trim pressure for descent
- ✓ Request landing permission (if required)
- ✓ Enter traffic pattern (if required) and check engine instruments

3.14 Before touchdown check

- ✓ Check all systems
- ✓ Land against the wind (if possible)
- ✓ Approach with 100-110 km/h (not under 90 km/h)
- ✓ Adjust trim pressure
- ✓ Landing lights?

3.15 Go around procedure

- ✓ Full throttle
- ✓ Adjust trim pressure
- ✓ Set speed for best ascent rate (90–110 km/h)
- ✓ Check engine instruments
- ✓ Minimum safe altitude reached?
- ✓ Engine settings as required

3.16 Touchdown

- ✓ Reduce speed shortly before touching ground (reduce engine power) and land softly on the main gear.
- ✓ Keep the stick pulled back all the way (toward body) and reduce speed using the rotor until standing still.

Warning: If the gyrocopter starts to roll backwards in case of strong head wind, the brakes are not to be used to stop under any circumstances. Instead, use the engine throttle and add power.

- ✓ When rotor speed is below 150 RPM the control stick should be brought into the front middle position to reduce the risk of damage to the rotor and empennage.
- ✓ Slow the rotor down and push the stick all the way forward.
- ✓ In case of side wind, position the rotor as required.

3.17 After landing check

- ✓ After complete landing, push the stick all the way forward
- ✓ In case of strong wind, bank rotor against the wind as required
- ✓ Engage rotor brake and push stick all the way forward
- ✓ Taxi with adjusted throttle in a brisk walking speed (use wheel brakes if required)
- ✓ Initiate turns at low speed using pedals (due to risk of tipping)
- ✓ Turn off cabin heat (optional)
- ✓ Adjust ventilation as required
- ✓ Landing lights?
- ✓ Secure gyrocopter against rolling with parking brake when at parking position
- ✓ Set rotor brake to park position and secure

Warning: Taxi with caution and at low speed when turning due to the high risk of tipping!

Warning: The cabin may only be opened when the gyrocopter and rotor are standing still.

3.18 Engine shut down

- ✓ Lights, radios and transponder (if available) „OFF“
- ✓ Engine RPM to idle
- ✓ Note flight times and turn off main instrument (glas cockpit)
- ✓ Both ignition switches to „OFF“
- ✓ Master switch „OFF“

Warning: The gyrocopter may not be exited untill the parking break is engaged and both rotor and prop are standing still.

3.19 Securing the gyrocopter

- ✓ Adjust ventilation as required
- ✓ Attach rotor bag and secure the rotor
- ✓ Hardtop as required
- ✓ Close and lock cabin

3.20 Installing and uninstalling the rotor

To transport or store the gyrocopter with minimal space requirements the rotor may be dismounted. This must be done with the help of a second, instructed person (at least) to avoid damage to the rotor system or the gyrocopter.

Warning: The instructions of how to handle the rotor system must be followed! In case of mishandling, the rotorsystem may be damaged and may not be used for flight without inspection by an authorized aviation service work shop.

3.21 Handling the rotor system

The mounted rotor system is either to be removed by at least two persons at the center of gravity of the blades (approximately 2.5 m from the middle) or at the center of gravity (middle) of the entire rotor system.

Note: In case of mishandling of the rotor system all warranties are void!

3.21.1 Uninstalling the rotor

1. The gyrocopter must be secured against rolling off with the parking brake on plain ground and the rotor centered lengthwise.
2. Standing on a ladder, remove the safety split pin and the Titer-bolt nut.
3. The Titer-bolt is to be removed by hand (not using a hammer or using force). If required wobble the rotor lengthwise to make sure the bolt doesn't cant.
4. An instructed person must hold the rotor at the back side of the gyrocopter.
5. Lift the rotor system vertically out of the hub with care.
6. Remove the rotor system from the gyrocopter off to one side, taking care not to damage the propeller or the empennage.
7. The rotor system may not be laid down on a dirty or rough surface since the blades may get damaged or scratched. It is best to place it on two jacks placed under the center of each blade.

3.21.2 Dismantling the rotor system

1. To dismantle the rotor system, lay it upside-down on two jacks or a clean surface.
2. The 4 outer locknuts which secure the rotor blade must be removed from one rotor blade while the fitted bolt on the lower side of the blade must be countered with a wrench.
3. All the fitted bolts can now be removed without using any force by gently wobbling the rotor blade up and down to keep the screws from canting.
4. Carefully pull the rotor blade out away from the rotor hub.
5. Repeat steps 2 - 4 for the second rotor blade.
6. The rotor hub itself and its screws may not be dismantled.
7. Rotor blades and rotor hub should only be stored and transported in bubble wrap or similar material to avoid damage and scratch.

3.21.3 Assembling the rotor system

1. The rotor blades and the rotor hub are labeled with red and black dots.
2. Carefully position the first rotor blade with the appropriate marking in the correct side of the rotor hub with the flat side facing down. Gently wiggle the blade up and down while doing so to avoid canting the blade.
3. Now carefully and forceless, slide the screws in from the top while gently wiggling the blade up and down.
4. Slide the washers onto the screws and screw the locknuts on tightening them lightly.
5. Afterwards tighten all screws with a torque wrench starting from the inside and finishing with the outer one.
6. Repeat steps 2 - 5 for the second rotor blade.

Warning: A life threatening condition may arise, if the rotorsystem is mishandled.

Note: In case the rotor system is mishandled, all warranties for the rotor system are void!

3.21.4 Installing the rotor

1. The gyrocopter must be secured against rolling off with the parking brake on plain ground and the titer tower centered lengthwise.
2. Check mounting direction: The titer tower and rotor hub are each marked with colored dots on both sides.
3. Lift the rotor blade with an instructed person (one at the back and one just behind the rotor hub in flight direction).
4. Bring the rotor system closer to the gyrocopter from one side, paying attention not to damage the propeller or the empennage. Standing on a ladder, settle the rotor hub centered into the titer tower.

5. The second person may now release the rotor system.
6. Push the main bolt back in from either side with the flat hand.
7. Check mounting direction: The titer tower and rotor hub are each engraved with corresponding letters on both sides.
8. If the main bolt cannot be pushed in, the rotor is to be gently wobbled lengthwise with the other hand.
9. Put on the washer and tighten the crown nut hand tight, then secure it with the safety split pin. The main bolt must be rotatable by hand.

3.22 Propeller

The gyrocopter ***G 4-2*** is delivered with a ground adjustable propeller as a standard. In flight adjustable prop is optional.

Warning: It is recommended to read and follow the instructions given in the manufacturer´s manual of engine and propeller.

Note: In case of mishandling or wrong operation of the propeller and/or the engine the warranties for for the propeller and/or engine will be void!

Attention: The propeller may **ONLY** be removed, checked, maintained and installed by an authorized specialized company.

4 FLIGHT PERFORMANCE

4.1 Introduction

The following data has been collected during test flights. It is only valid when the gyrocopter, rotor, propeller and engine are in an immaculate condition, the propeller and the rotor are clean and the pilot disposes over average flying skills.
The performances listed here are under standard conditions (sea level, 1013 mbar, 15 °C, no wind, take-off weight 450 kg, and smooth runway with short turf in good condition). Higher airports, higher temperatures, higher humidity and lower atmospheric pressure can dramatically affect the performance data.

4.2 Performance data

Speeds

Minimum speed (**V**$_{S0}$)	40 km/h
Manouver speed (**V**$_{A}$)	100 km/h
Most economical cruising speed	120 km/h
Maximum permissible speed (**V**$_{NE}$)	167 km/h

Take-off distance

Take-off ground roll (*)	50–200 m
Take-off ground roll over 15 m obstacle (*)	300 m

(*) = *Depending on wind speed and weight*

Touch-down distance

Touch-down ground roll with brakes (*)	0 – 30 m
Touch-down ground roll over 15 m obstacle (*)	150 m

(*) = *Depending on wind speed and weight*

Climb performance

One seated (380 kg TOW)	6 m/s at 100 km/h
Two seated (450 kg TOW)	4 m/s at 100 km/h

Maximum endurance

With 1 tank and TOW 450 kg (*)	240 km
(*) = at economical speed of	120 km/h
(*) = at rotor speed of	370 RPM

Endurance with lighter weight is much higher!

4.3 Influence of rain & insects on flight performance

In case of a constant loss of power in horizontal flight at constant speed, a dirty rotor (for e.g. because of insects) may be the reason. This may go so far, that horizontal flight is no longer possible, even with full engine power. For this reason, the rotor is always to be kept clean.
The gyrocopter ***G 4-2*** is designed for VFR flights only. However, flying through heavy rain, moisture may reduce and performance performance beside the possibility that electronic equipment may suffer some damage.

4.4 Demonstrated maximum crosswind component

The maximum demonstrated crosswind is 35 km/h.

4.5 Noise data

G 4-2 complies with the noise abundance regulations in Germany, which limit a maximum of 68 dB(A) at the time of its certification.

4.6 Tire pressure

Main landing gear	3.0 Bar
Nose wheel	2.5 Bar

4.7 Service ceiling

The service ceiling defines the altitude, at which the maximum rate of climb of an aircraft is 0.5 m/s with maximum continuous engine power and MTOW.
The service ceiling with Rotax 912 ULS is 8.000 ft. (approx. 2450 m)
The service ceiling with Rotax 914 UL is 10.000 ft. (approx. 3050 m)
The service ceiling with Rotax 912 ULS is 12.000 ft. (approx. 3660 m)

4.8 Bolt tightening torques

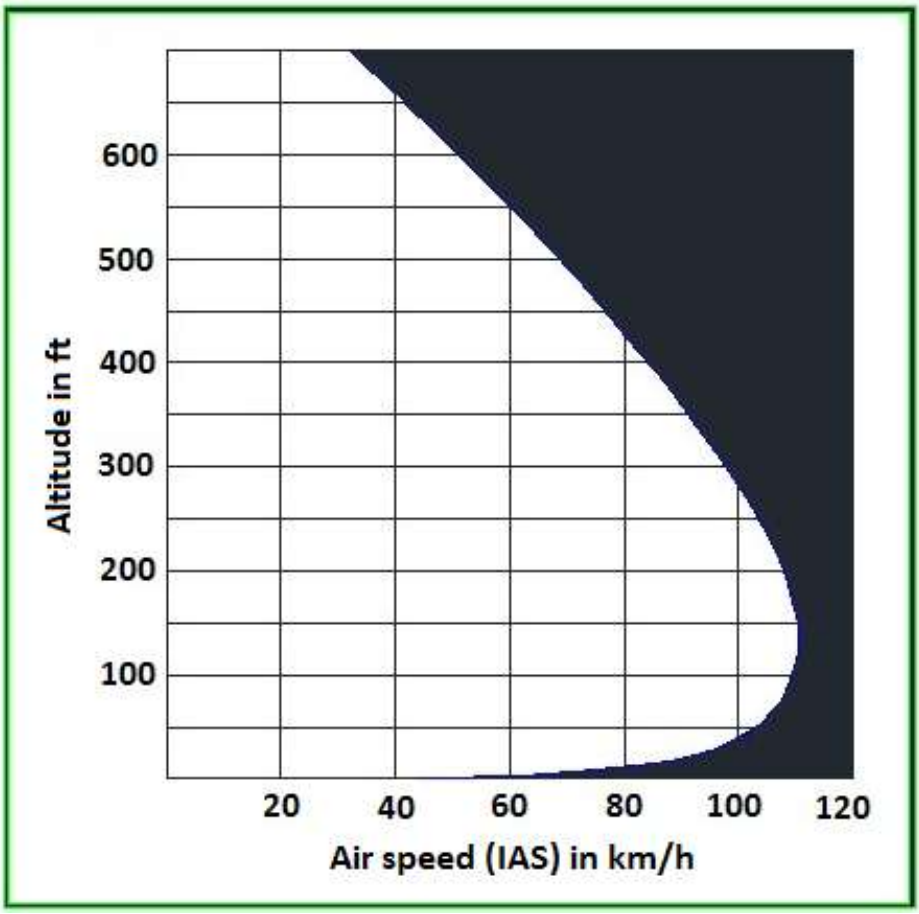
All bolts and nuts are to be tightened to the torques indicated in the maintenance manual. In case of doubts, the mechanic or maintenance company must contact the manufacturer of the gyrocopter. Engine bolts must be tightened to the engine manufacturer's specifications.

4.9 Battery / generator

Attention: The battery must not be low discharged otherwise it may get damaged and must be replaced.

4.10 Altitude / Air speed - Diagram

The altitude/Airs peed-diagram indicates the air speed (IAS) at a certain altitude, at which a safe landing is still possible.



5 WEIGHTS AND CENTER OF GRAVITY

5.1 Introduction

This section contains the maximum load, procedure to weigh the gyrocopter, current empty mass and empty moment of mass and the method of calculation to determine the flight mass and center of gravity as well as a list of all installed equipment when the gyrocopter was weighed before leaving the manufacturing plant.

Warning: Exceeding the CG-limits of the gyrocopter may have fatal consequences. Add-ons and the installation of further accessories must be done by an authorized service work shop and must be documented in the manual of the gyrocopter.
The operator of the gyrocopter is obliged to maintain current data in this manual and make correct documentation after any change.
The pilot in command is obliged to calculate the pay load and to make sure that the CG is within the permissible limits. The valid MTOW may not be exceeded.
The minimum pilot's weight is **65 kg**. Lighter pilots must carry extra weight in a waste haness. Tha maximum pilot's weight is **125 kg**.
The CG in the X-direction must be between **1960** and **2200** mm.

Note: The manufacturer must be informed about all alterations and the installation of additional equipment; otherwise the warranty may be void.

5.2 Weighing procedure

The ***G 4-2*** is delivered ready to fly with all installations and additional equipment and accessories. The empty weight and the CG are indicated in this manual (see section 5.3).
To determine the weight of the gyrocopter, it is placed on 3 certified scales, one scale under each wheel. The indicated weights are then added together.

The mass moments in X directions must be calculated and then divided by the total weight to determine the center of gravity. The table in section 5.5 is necessary to determine the center of gravity. It contains the weights and the CG of the gyrocopter as well as the CG of occupants, luggage, fuel and all equipment in the instrument panel.

The determination of the CG is important and must be done by the pilot in command prior to every flight.
The permissible CG limits must consider.
The maximum take-off weight must be observed.
The gyrocopter's operator is responsible to keep the correct and current data in the operating manual.

Achtung: The connecting plates between the mast and the rotor head are used in 2 different shapes marked A or B. Plates marked A are used whenever propeller-type DUC Windspoon is installed. Plates marked B are used whenever propeller type CL3 or type TLX3 is installed.
The connecting plates are not to be exchanged.

5.3 Weighing report

Serial No.:	**001-11**
Registration:	**D-MTRX**
Clor:	**Orange, Metallic**
Operator:	**Rainer Farrag**
MTOW	**500 kg**
Empty weight including accessories:	**272 kg**
Maximum payload:	**178 kg**
CG in X-direction:	**2320 mm**

Name Date Signature:

_____ _____ _____

Maximum take-off weight with Rotax 912 ULS:	**500**	**kg**
Maximum take-off weight with Rotax 914 UL:	**530**	**kg**
Maximum take-off weight with Trixy 912 TI:	**560**	**kg**
Minimum load on front seat:	**65**	**kg**
Maximum load on front seat:	**125**	**kg**
Empty CG limitation in X-direction	**2250 – 2400**	**mm**
Flight CG limitation in X-direction	**1900 – 2200**	**mm**

Warning: Any change which has effect on the mass and/or center of gravity must be noted in section 5.4 (empty mass alteration) and this must be considered by the pilot in command. The neglancy may have fatal consequences!

5.4 Empty weight alteration

Any change, which has effect on the mass and/or center of gravity, must be noted in this section. Such changes may only be excuted and documented by an authorized aviation work shop. The oprator of the gyrocopter is responsible for keeping the documents up-to-date.
The pilot in command must consider the valid and current weights and CG.

Equipment added: **kg**
Equipment removed: **kg**
Weight: **kg**
New empty weight: **kg**
New center of gravity in X-direction: **mm**

Date: **Signature:**
Stamp of specialized company:

Equipment added: **kg**
Equipment removed: **kg**
Weight: **kg**
New empty weight: **kg**
New center of gravity in X-direction: **mm**

Date: **Signature:**
Stamp of specialized company:

Equipment added: **kg**
Equipment removed: **kg**
Weight: **kg**
New empty weight: **kg**
New center of gravity in X-direction: **mm**

Date: **Signature:**
Stamp of specialized company:

Equipment added: **kg**
Equipment removed: **kg**
Weight: **kg**
New empty weight: **kg**
New center of gravity in X-direction: **mm**

Date: **Signature:**
Stamp of specialized company:

Equipment added: **kg**
Equipment removed: **kg**
Weight: **kg**
New empty weight: **kg**
New center of gravity in X-direction: **mm**

Date: **Signature:**
Stamp of specialized company:

5.5 Determining the center of gravity

Explanation:
Hereafter is an example (see weighing report in section 5.3).

	Weight in kg	X in mm	X-Moment
Empty weight	272	2320	631040
Pilot	80	1190	95200
Co-Pilot	73	1950	142350
Luggage	5	1950	9750
Fuel	20	2215	44300
Summ	**450**		**922640**
CG	**= 922640 / 450 = 2050 cm from datum**		

The empty mass of the gyrocopter is 272 kg (last valid).
The center of gravity is located 2320 mm from the Pitot-tube's leading edge in X-direction.
The X-Moment = 272 * 2320 = 631040
Sum of all weights = **450 kg**
Sum of all X-moments = 922290
The CG of the loaded gyrocopter in X-direction is calculated:
922290 / 450 = **2050 mm**

Warning: The center of gravity must be within the following limits:
In X-direction between 1900 mm and 2200 mm
The pilot's mass must be between 65 and 125 kg.
The valid MTOF must be observed.

The CG is calculated by the pilot in command in the following table (for help see example above):

	Weight in kg	X in mm	X-Moment
G 4-2 R / RT (leer)	**Use last valid data!!**		
Pilot		**1190**	
Co-Pilot		**1950**	
Luggage		**1880**	
Fuel weight		**2215**	
Summ			
CG at take-off			

The last valid empty weight and last valid CG must be taken over from the weighing report (section 5.3) and/or from the last valid entry in section 5.5.
The maximum take-off weight may not exceed 450 kg.
The CG must be between 1963 mm and 2127 mm in X-direction.

The following specifications are to be considered for the empty gyrocopter:

The CG must be between 2250 mm and 2400 mm in X-direction.

6 SYSTEMS DESCRIPTION

6.1 Introduction

This section contains descriptions and operating instructions for the gyrocopter and its systems.
Instructions for the use of auxiliary equipment can be found in the operating manual of the equipment´s manufacturer.

6.2 Gyrocopter description

G 4-2 is a gyrocopter with 2 seats in tandem configuration. The model ***Liberty*** is designed for operation with an open cabin. The cabin can be enclosed with an optional kit. The model ***Princess*** is designed for operation with an enclosed cabin. The cabin can be converted with an optional kit for open operation. The light canopy is made of carbon fiber composite and opens around hinges on the left side of the cabin. It is lockable and may optionally be equipped with removable cabin glass. Consequently the gyrocopter can be flown with open- or closed cabin.
The cabin is also made of carbon fiber composite.
The model ***Liberty*** is equipped with a simple windshield made of PC. The model ***Princess*** is equipped with an integrated windshield in the canopy made of formed, unbreakable PMMA-material.
The engine cowling consists of 6 parts made of reinforced carbon fiber. The upper parts of the cowling are hinged for easy access to the engine and accessories.
The gyrocopters frame is made of special stainless steel and is welded under gas-shield.
The empennage structure is made of carbon fiber composite.
The power plant is attached to the back of the mast via a steel tube ring and 4 vibration dampeners.
The rotor blades are made of extruded aluminum.
The main gear strut is made of GFC/CFC for flexibility.
The nose wheel suspension consists of a stainless steel fork and axles, which are welded and mounted steerable inside a steel guide at the front edge of the frame.
The fuel tank is made of rubber fabric in an anti-explosive construction.

6.3 Steering systems

Rudder steering

The rudder controls are conventional pedals and steel wires. A set of pedals (adjustable for more comfort) in the nose of the cabin are connected to the nose wheel control via rods. The steel wires controlling the rudder are attached to the nose wheel controls and lead back to the rudder inside the frame.

Optionally a second set of pedals may be installed for the co-pilot which is also connected to the set of pedals in the front via rods. This way the rudder can be controlled from both seats.

Throttle and wheel brake control unit

The throttle and the choke are on the left side of the pilot's seat. The throttle lever is connected to the carburetors via cable controls, whereby the back position is idle and the forward position is full power.

An engine cold start requires choke control. For this purpose the choke lever must be pulled all the way back (towards the throttle) and the throttle is sat to idle. After starting the engine a short warm up phase should follow before returning the chocke lever all the way to the forward position.

Optionally a throttle lever can be mounted left of the co-pilot's seat and is then connected to the front throttle lever via rods.

Rotor steering

The rotor head is controlled by the control stick in front of the pilot's seat. The stick moves control rods under the seats. These are linked by a fork to 2 vertical rods which connects to the rotor head. The limitations for pitch and roll are in the rotor head.
A change of position of the control stick directly affects the gyrocopter's attitude in the air. Vigorous movement of the stick is strictly prohibited. The proper way to handle the control stick is learned during the corresponding course in a flight training school.
Furthermore the PTT and trim-buttons are located on the stick.
A co-pilot control stick is optional and is directly attached to the rods under the seats in the cabin.

Trimming

Electrical operated rack and pinion triming device is installed under the rear seat. It is connected to the control rods under the seat through spring coil. Actuating the trim button on the control stick trims the gyrocopter for fast (to the front) or slow flight (to the back).
Optional trim button for the co-pilot may also be installed.

Rotor brake

The rotor is slowed down and stopped by a brake, which is mounted in the rotor head. With the control stick pushed all the way forward, the brake pad is pressed on the rotating gear disk in the rotor head and slows the rotor. It is absolutely prohibited to activate the rotor brake during flight. The rotor brake is only actuated after landing.

Hydraulic wheel brakes

The hydraulic wheel brakes are regulated by pulling the brake lever which is installed on the throttle control lever. The hydraulic brake acts on both main gear wheels at the same time. When standing still, the wheel brake is to be fixed with the locking button (parking brake).
Optional brake lever is installed for the co-pilot on the back throttle control lever and is directly connected to the pilot's brake lever.

Nose wheel steering

The nose wheel is controlled by the pedals for the side rudder via rods.

Pre-rotator control

To pre-rotate start the rotor, the pilot must push a pedal, which pulls a wire to actuate a belt clutch, drive shafts and a bendix gear. The control stick must be kept in the front quarter position with the trim in the most forward position to avoid collision between the rotor blades and the empennage.
To deactivate the pre rotation process, the pedal must be released.
A slide pre-rotator slide pedal type may be used in older models (see picture in 6.3 Steering systems).

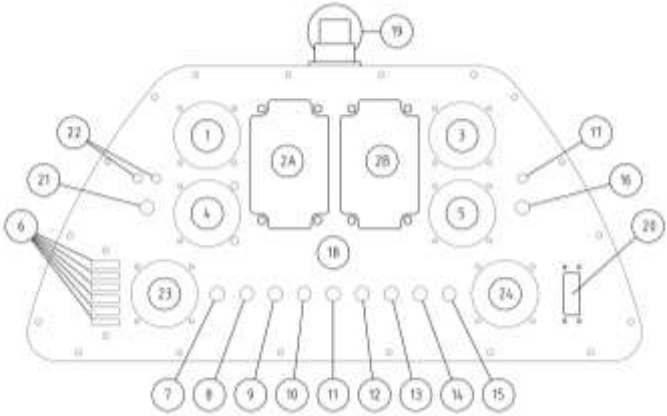
Warning: Before activating the prerotator the pilot must make sure that the rotor area is clear.

Warning: The rotor must be trimed forward and the pilot must hold the stick in the front quarter position prior to and during the prerotation process. The stick may only be pulled back at or above 180 RPM.

6.4 Instrument panel

Type *LIBERTY*

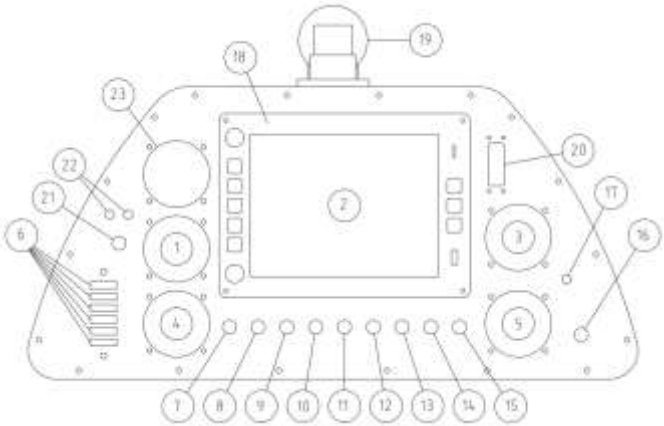
The standard Liberty panel is designed das shown in the illustration below. It includes all the necessary instruments and may optionally be equipped with a second Mini-Glascockpit (EMSIS) for GPS-navigation.



1. Mechanical Air Speed indicator
2. EMSIS II (A=Standard / B=GPS / optional)
3. Mechanical Altimeter
4. Transceiver (optional)
5. Transponder (optional)
6. Circuit breakers
7. Main Switch
8. Mag 1 (ignition circuit switch 1)
9. Mag 2 (ignition circuit switch 2)
10. Auxiliary Fuel Pump (optional)
11. Avionics Switch (Transceiver, Transponder and EMSIS)
12. Landing Light Switch (optional)
13. Navigation Light Switch (optional)
14. Heating set Switch (optional)
15. Defroster Fan Switch (optional)
16. Start Switch (engine starter)
17. GEN (alternator status Indicator)
18. Aircraft ID
19. Magnetic compass
20. ELT (optional)
21. Booster reset switch (Rotax 914 UL engine only)
22. Booster warning lights (Rotax 914 UL engine only)
23. Controller for constant speed propeller (optional)
24. Engine and Rotor RPM

Type *PRINCESS*

The standard princess panel is designed as shown in the illustration below. It contains all instruments, GPS-navigation, circuit breakers and switches as well as optional electronic devices.



1. Mechanical Air Speed Indicator
2. NESIS glass cockpit (main instrument)
3. Mechanical Altimeter
4. Transceiver (optional)
5. Transponder (optional)
6. Circuit breakers
7. Master switch
8. Mag 1 switch (ignition circuit switch 1)
9. Mag 2 switch (ignition circuit switch 2)
10. Electric Fuel Pump switch (optional)
11. Avionic master switch (optional)
12. Ldg Lt switch (landing light)
13. Nav Lt switch (optional navigation and strobe light)
14. Heating fan switch (optional)
15. Ventilation Fan switch
16. Start switch (engine starter)
17. Gen (alternator status indicator)
18. Aircraft ID
19. Compass (magnetic compass)
20. ELT remote control (optional)
21. Booster reset switch (Rotax 914 UL engine only)
22. Booster warning lights (Rotax 914 UL engine only)
23. Controller for constant speed propeller (optional)

6.5 Undercarriage

The undercarriage is made up of the main landing gear with tire size 4.00-6“and the nose wheel with tire size 3.50-4“.
The main landing gear consists of a fiber reinforced composite strut, which is attached to the frame at its middle. The tips carry the main wheels, which are equipped with hydraulic brakes.
The nose wheel is held inside a stainless steel fork. The fork may be rotated inside a steel holder welded in the front part of the steel frame. The nose gear construction is connected through rods to the pedals.
The main landing gear and the nose wheel are maintenance-free.
The main wheel bearings are to be checked and the front wheel shaft may be greased as a part of the regular maintenance. The tires must be changed when in bad condition (worn-down tread or visible damage).
The main wheel bolts on the strut must be checked prior to every flight.

6.6 Seats and seat belts

All seats are made of carbon fiber composite. They are appropriately re-enforced and are attached to the frame. Thus, the pilot’s mass is directly loaded on the frame.
The gyrocopter must be flown from the front seat and the seat belts in the back must be fastened so they cannot catch on the co-pilot´s stick (if installed) in case that the rear seat is not occupied.
Both seats are equipped with 4-point seat belts which are attached directly to the frame.

6.7 Luggage compartments

Warning: Hard or sharp edged objects may damage the structure of the gyrocopter in turbulent conditions. This may have fatal consequences.
Warning: the lugage must be secured in the lugage compartments prior to every flight.

G 4-2 is equipped with two luggage compartments under the back seat. The maximum load is 5 kg per compartment. Hard or sharp edged objects may not be stowed in these compartments.

6.8 Doors, windows and exits

The ***G 4-2*** canopy is attached to the left side of the cabin (in flying direction) through hinges and has a locking mechanism on the right side. The canopy is uncovered above in standard version. A windshield of unbreakable PMMA is attached to the front part of the canopy in the standard version.
Optionally a removable unbreakable PMMA cover fitted in a carbon fiber reinforced frame and equipped with 2 Snap-On vents may be used. This glass cover is to be installed and secured on the ground as required.
Embarkation or disembarkation is on the right side of the gyrocopter.
Glass is to be cleaned only with water and a soft cloth. Do not use cleaners with solvents.
The glass must be replaced, if it shows cracks or is badly scratched.

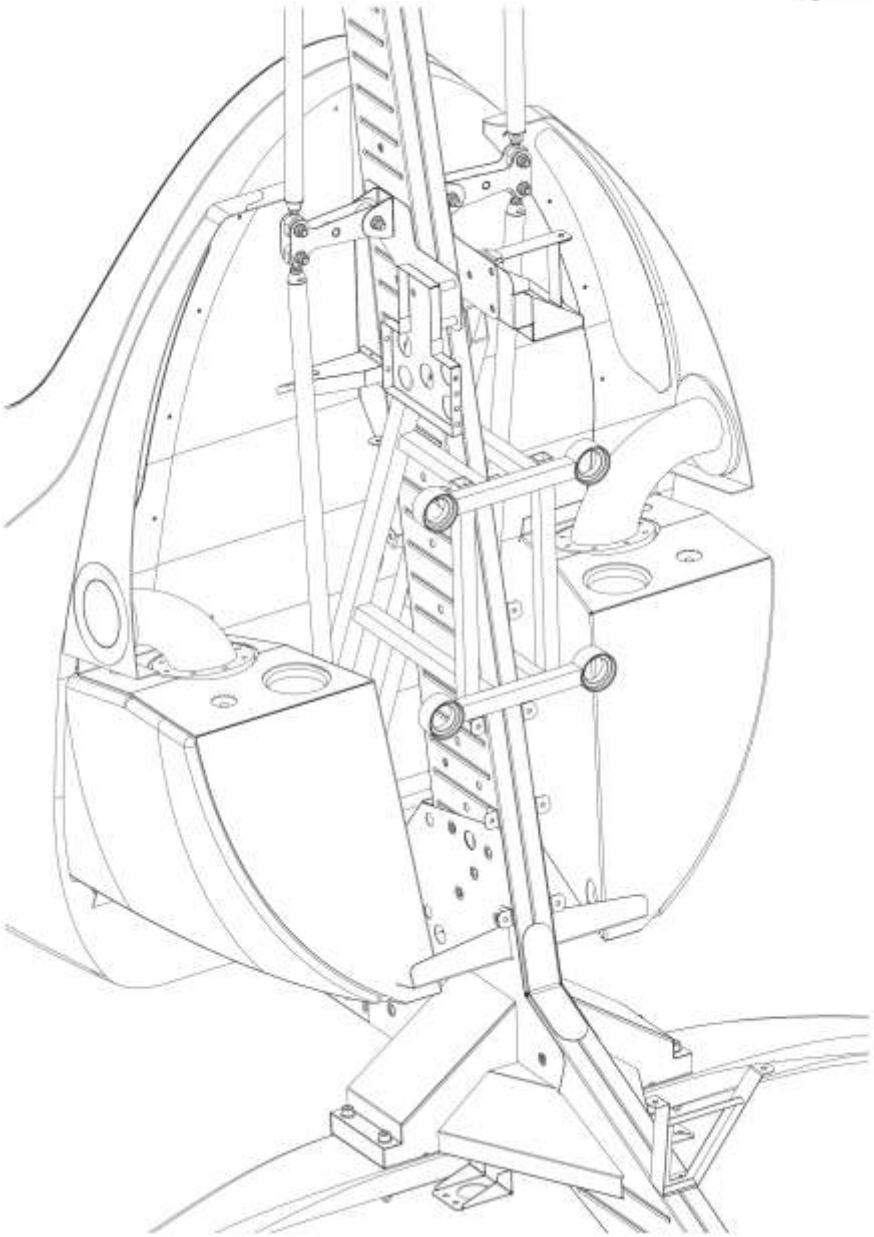
6.9 Fuel system

G 4-2 is equipped with one anti-explosive tank (34 l volume) at the right side of the passenger seat in standard configuration. Optional auxiliary tank (34 l volume) may be installed on the left side of the seat. In this case both tanks are connected through a hose and both feed the engine simultaneously. The tank(s) is filled from the right side. The fuel flow from the right tank to the left tank is rather slow. Fast fueling may fill the right tank, while the left tank may stay partly filled. Slow fueling is recommended when equipped with 2 tanks. Wait for 3 minutes before checking the fuel quantity in the tanks.

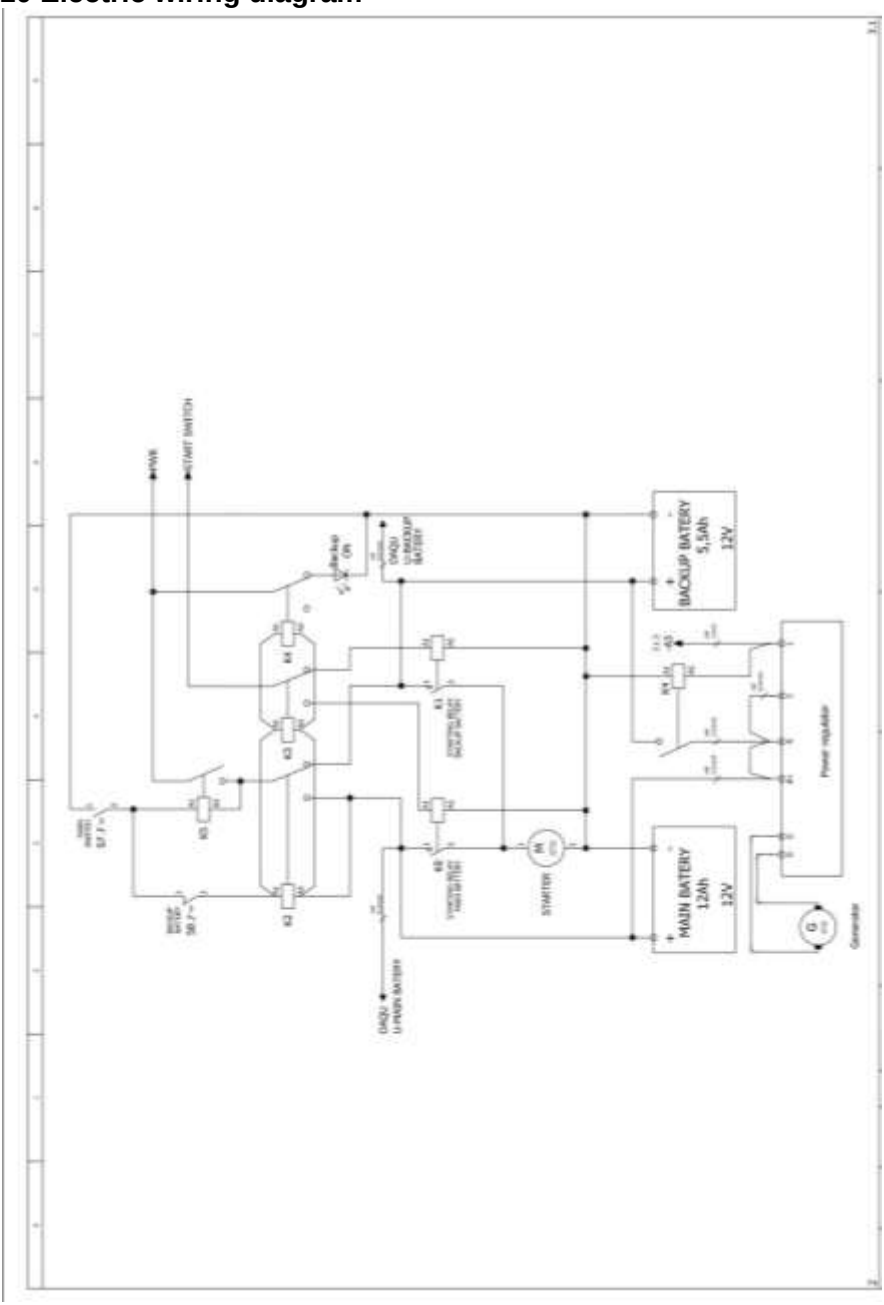
A fuel drain with a shut-off valve is installed under the frame (in front of the main gear strut) to check the fuel. A transparent hose with markings is also delivered with the gyrocopter to visually inspect the fuel quality as well as the quantity. For this purpose, the hose is to be attached to the drain valve at one end. The other end of the hose is to be held beside the tank filling opening at the middle position. The shut off valve is then to be opened and fuel flows from the drain into the hose where the fuel quality can be inspected. The fuel quantity may be visually checked with the help of the markings on the hose.

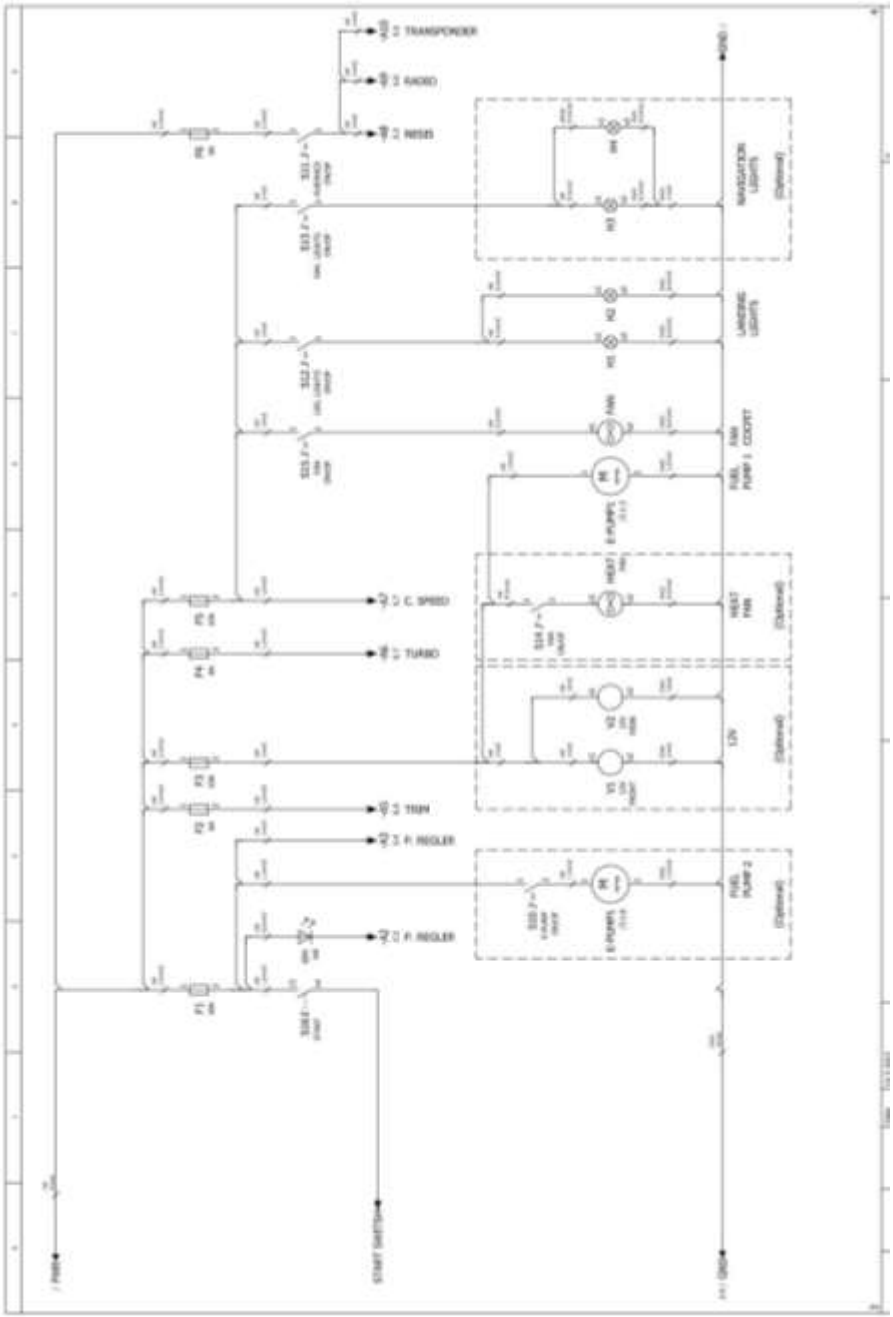
A standard electronic fuel gage installed in the right tank and is connected with the glass cockpit. The fuel quantity will show a maximum capacity of 34 l with one tank or 68 l with two tanks installed. The 912 ULS engine is equipped with a mechanical fuel pump. An electric auxiliary pump is optional. It may be turned on/off by a switch in the cockpit in case of fuel pressure loss.

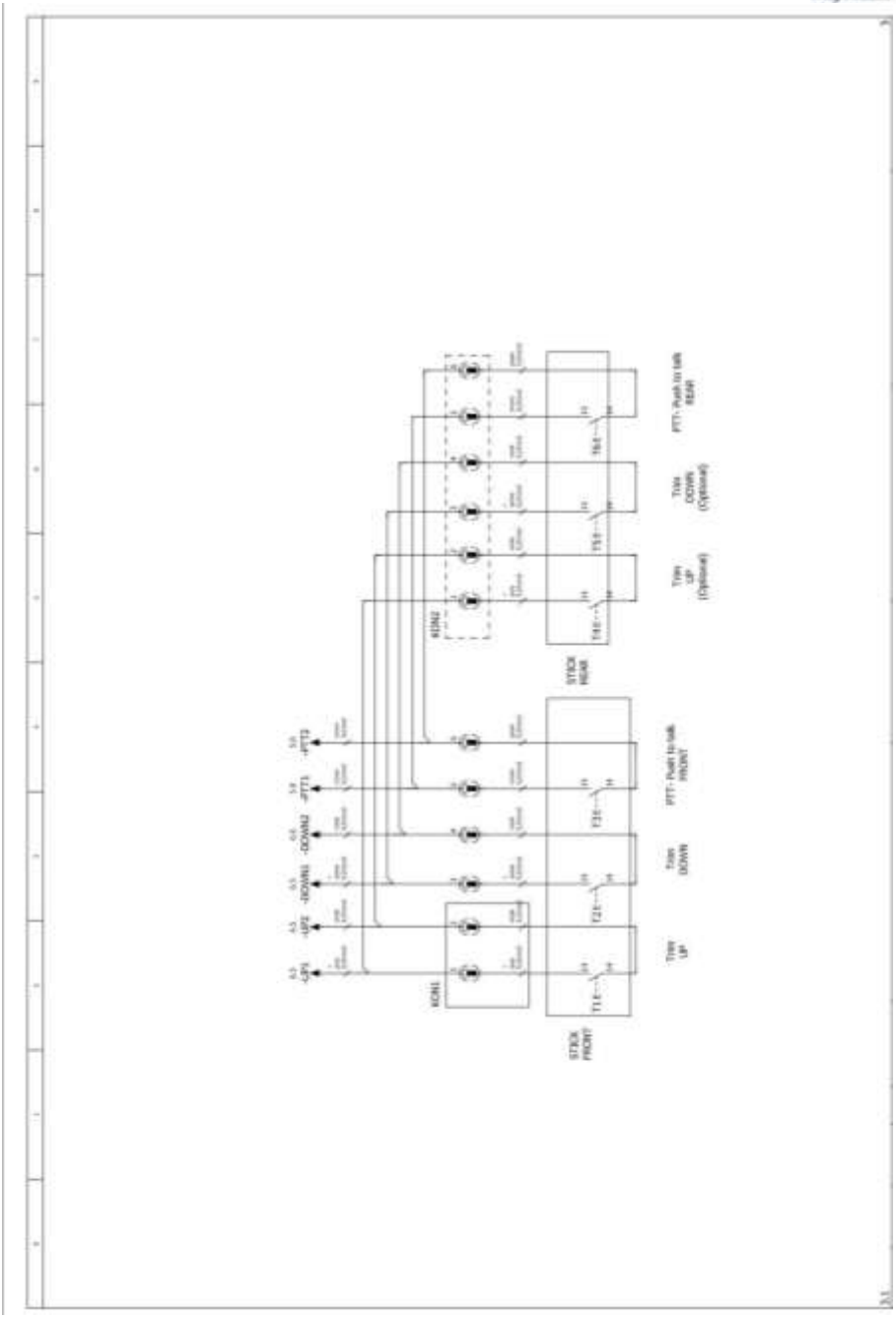
Attention: The regular inspection of the fuel filter (every 50 hours) is very important for flight safety.

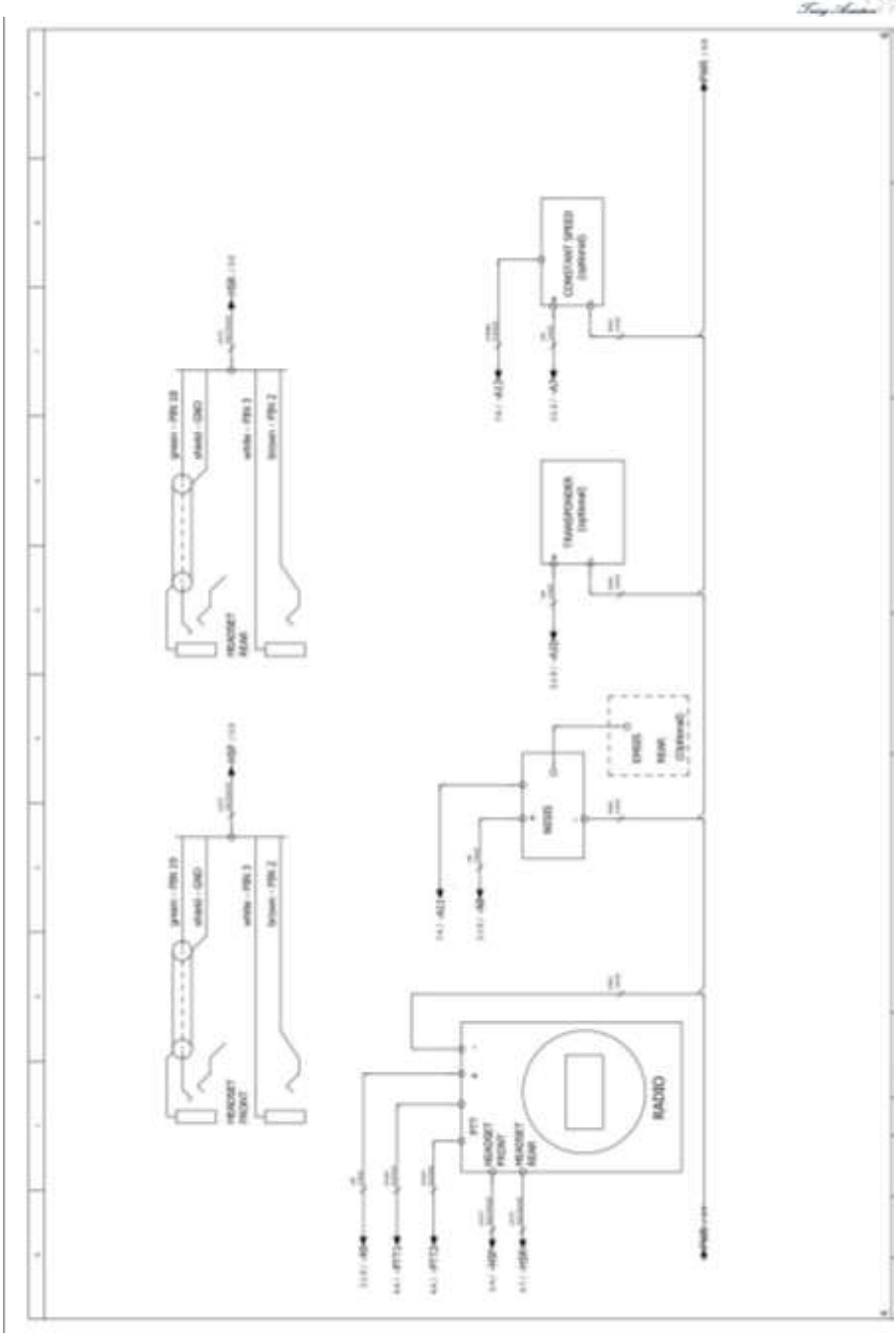


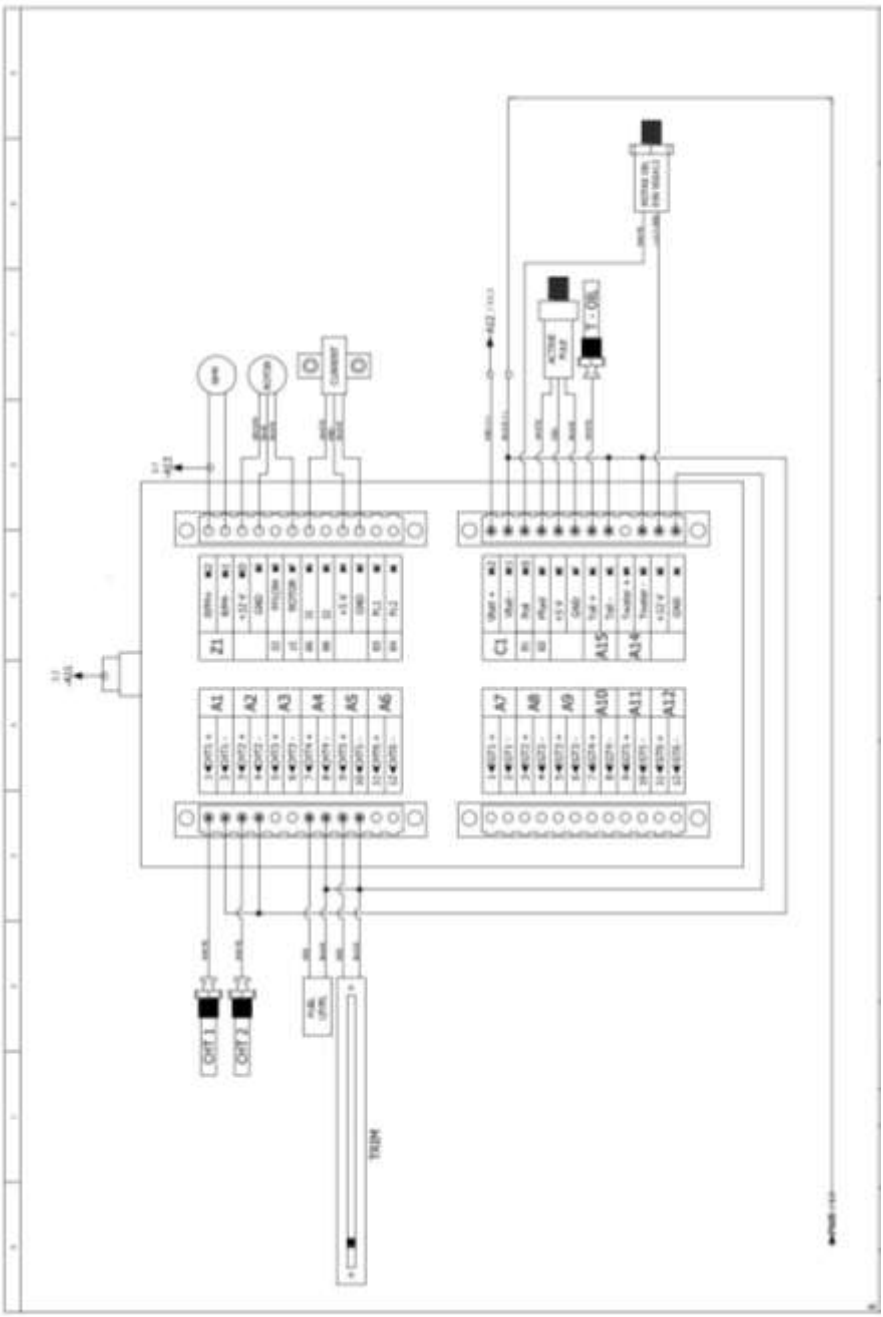
6.10 Electric wiring diagram




TRANSPONDER
RADIO
NAVIGATION LIGHTS
LANDING LIGHTS
FAN
FUEL PUMP 1
E-PUMP
HEAT FAN
C. SPEED
TURBO
TRIM
A. REGLER
FUEL PUMP 2
START SWITCH




RADIO
HEADSET REAR
HEADSET FRONT
PTT
TRANSPONDER (optional)
CONSTANT SPEED (optional)
EMOS
EMOS REAR (Optional)
green - PIN 10
shield - GND
white - PIN 3
brown - PIN 2


Z1
C1
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A15
A14
ORT 1
ORT 2
TRIM

6.11 Dynamic- and static- pressure system

G 4-2 is equipped with static pressure and dynamic pressure systems.

The dynamic pressure is taken from the Pitot-tube at the nose and guided to the NESIS glass cockpit with a hose. The dynamic pressure is required to determine the air speed.

The static pressure is measured at the left side of the cabin and is attached to EMSIS / NESIS through a hose.

Attention: The cleanliness of the dynamic- and static pressure systems is important for precise measurements of air speed and altitude. A check prior to every flight is recommended.

7 GLASS COCKPIT

7.1 Introduction

The Mini-Glascockpit ***EMSIS*** is specially designed for the Model ***Liberty*** und the Glascockpit ***NESIS II*** is specially designed for the Model ***Princess*** by ***Kanardia***. These units are directly connected to the board electrical circuit through the Nav-switch.

Note: The Glass Cockpit must be switched on (NAV-Switch) Right after the engine starts and must be switched off right before the engine is shut down. This is important to protect these units from damage due to high current.

They are connected to the Pitot-tube at the nose of the gyrocopter through a hose. They are also connected to the static pressure port at the left side of the cabin through a hose. (See chapter 6.11).

EMSIS

NESIS II

Warning: This manual includes only a brief description of EMSIS and NESIS. The pilot must read the operation manual of the unit in the units manual and get familiarized with the operation instructions befor flight.

7.2 Description

EMSIS

The standard equipment of the Model ***Liberty*** includes one Mini Glass Cockpit (EMSIS), which includes the following Instruments: air speed indicator, altimeter, vertical speed indicator, G-Meter (acceleration), CHT (2x), oil temperature, oil pressure, fuel gauge, fuel pressure, hour meter and other useful functions.
Engine RPM and Rotor RPM are displayed in a separate instrument.
A second ***EMSIS*** is optionally available for GPS navigation in ***Liberty***.

NESIS II

The standard equipment of the Model ***Princess*** includes one Glass Cockpit, which includes the following instruments and functions: air speed indicator, altimeter, vertical speed indicator, G-Meter (acceleration), GPS, moving map, electronic compass, engine RPM, CHT (2x), oil temperature, oil pressure, fuel gauge, fuel pressure, fuel computer, rotor RPM, hour meter, OAT, flight planner, data recorder and much more.
An optional traffic awareness system (ADS-B and FLARM) may be coupled to ***NESIS*** and displays the position of other aircrafts on the moving map.
NESIS II funktioniert auch im Model ***Princess*** als Bildschirm für eine optionale Bordkamera.

7.3 Operation

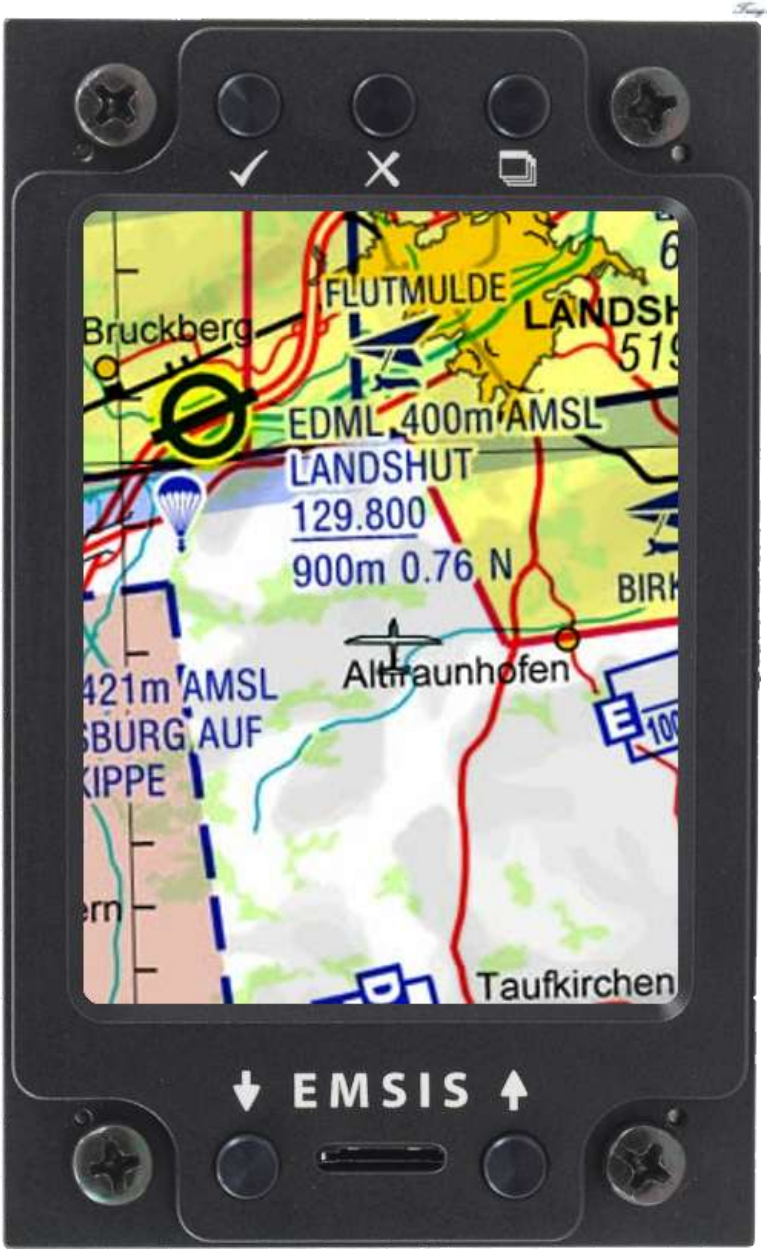
EMSIS is a modern Mini-Glass Cockpit, which is operated by 5 push buttons. A Mini-USB is also available for Software-Updates.

The operation manual is delivered with every gyrocopter equipped with this unit.

The main display shows air speed indicator, altimeter, QNH, vertical speed indicator, nick trim position, oil pressure, oil temperature, CHT (2x), fuel gauge, voltage and hour meter. OAT is optional.

Personal preferences can be set in the setting mode.

An optional Mini Glass Cockpit may be also installed for GPS navigation on the right hand side of the main ***EMSIS*** unit in the instrument panel.


FLUTMULDE
Bruckberg
EDML 400m AMSL
LANDSHUT
129.800
900m 0.76 N
Altfraunhofen
Taufkirchen
EMSIS

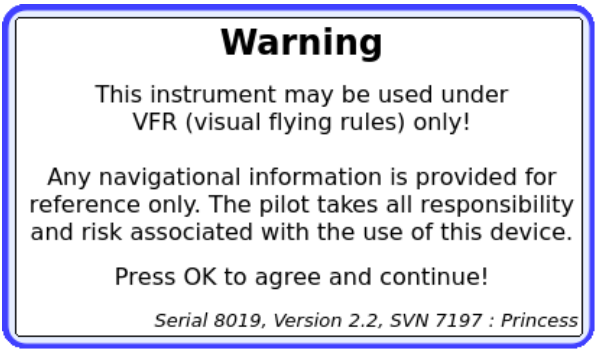
Nesis II is a modern Glass Cockpit, which is operated by 8 push buttons and 2 rotating knobs. The knobs may be also pushed in for additional functions. All buttons are labeled in 2 rows. A quick push on a button will open a window related to the subject listed on the upper row of the button. Pushing the button for 3 seconds will open a window related to the lower label.
Data downloads and updates uploads can be excuted via USB-Stick on the frame of the unit. A Mini-USB is also available on the unit's frame.

5 main displays are available in NESIS II. The upper rotating knub will change the the main display.

The operation manual is delivered with every gyrocopter equipped with this unit.

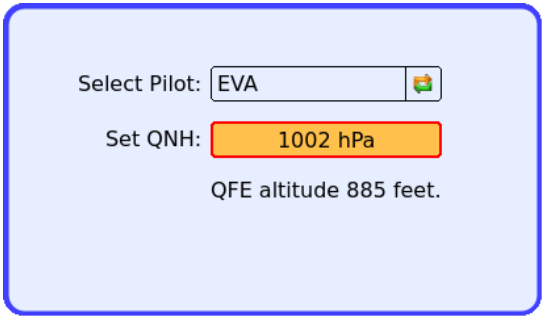
1- Rotating knob 1
2- Rotating knob 2
3- QNH button
4- NEAR/WPT button
5- ROUTE/BRWS button
6-LOG/LEGEND button
7- HDG/ALT button
8- VOLUME/BRIGHT button
9- USER button
10- ALARM/SETUP button
11- Mini-USB
12- USB

The screen of the unit illuminates after switching the unit on and the orientation process runs for a few seconds in the background and then the following warnig is displayed.


Warning
This instrument may be used under
VFR (visual flying rules) only!
Any navigational information is provided for
reference only. The pilot takes all responsibility
and risk associated with the use of this device.
Press OK to agree and continue!
Serial 8019, Version 2.2, SVN 7197 : Princess

The warning window also displays the serial No. of the software at the bottom of the window.

Pushing the rotating knob 2 in is the confirmation (OK) and this would enable the unit to continue the start process.
The second window allows the user to select a pilot name from a list which can be set in the setting menu. Confirming the name of the selected pilot with the rotating knob 2 (push in) will make the curser drop down into the box for setting QNH.



Rotating the rotating knob 2 will change the QNH setting and pushing it in will confirm the setting and then the main display 1 is on:

The first main display:

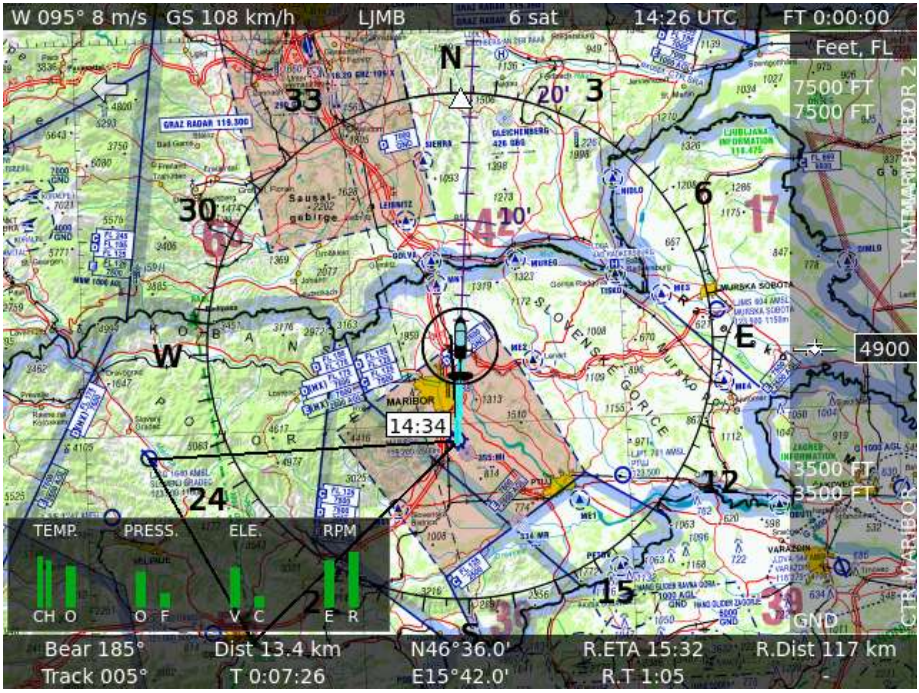
1- Indicated air speed
2- True air speed
3- Engine RPM (UPM x1000)
4- Manifold pressure
5- Rotor RPM
6- CHT (2x)
7- Oil temperature
8- Oil pressure
9- Fuel pressure
10- Circuit voltage
11- Cirsuit current
12- Turn coordinator
13- Fuel consumption l/h
14- Average consumption (l/h)
15- Range (km)
16- Endurance (h)
17- Fuel gauge
18- G-Meter (acceleration)
19- Vertical speed indicator
20- QNH
21- Altitude indicator
22- GPS (moving map)
23- Current position
24- Electronic compass

More information such as coordinates of current position, current time and ground speed are also displayed on this screen.

Nesis II displays warnings, whenever a value (oil pressure, CHT, max. air speed, min. rotor RPM, …..) gets out of the set limits. The illustration below shows a “Fuel Low” warning.
When connected to the transceiver and set for audio warnings, the NESIS II will also announce audio warnings in the head set. The user may enable or disable any of the warnings in the setting list of warnings. Audio (beep) or voice warnings may also be enabled or disabled in the same list. The range limits for each warning are predefined and cannot be changed by the user in the unit.

Turning the rotating knob 2 will result in zooming in or out in the moving map. Turning the rotating knob 1 will toggle between the 5 main displays.

The second main display (the navigation screen):



The following information is displayed on the upper edge of the screen: Wind (direction and speed), ground speed, air space, No. of Satellites in sight, current time and remaining flight time to destination.
Navigational information is displayed on the lower edge of the screen.
A transparent window will appear on the lower left corner of screen, once the engine is running: CHT (2 X), oil temperature, oil pressure, fuel pressure, voltage (V), current (A), engine RPM range and rotor RPM range.
Traffic awareness, ADS-B and Flarm (if installed) will be displayed on the moving map in this display.

Turning the rotating knob 2 will result in zooming in or out in the moving map. Turning the rotating knob 1 will toggle between the 5 main displays.

The third main display (the flight training screen):

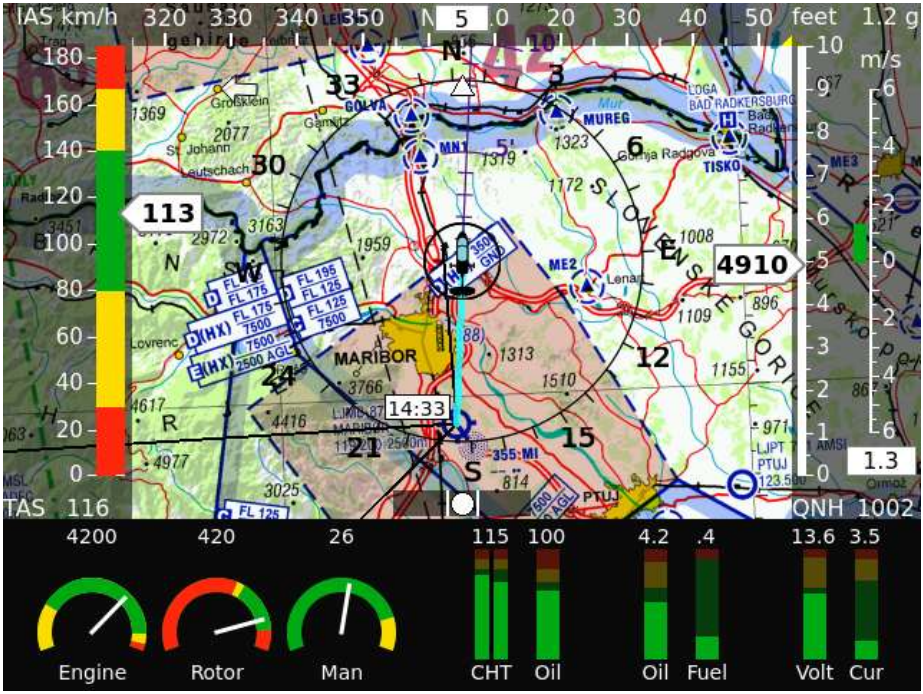
This display is designed for flight schools to teach student pilots in their initial training. It displays conventional instruments and does not contain any navigation data. This is suitable for VFR instruction with paper flight charts. This screen can be locked with a password, so that the student cannot chose a different display.
An additional small display may be installed with the optional traffic awareness system to enhance flight safety.

Warnings will be also displayed on this screen.

Turning the rotating knob 1 will toggle between the 5 main displays, if this screen was not locked with a password.

The fourth main display (the modern instrument screen):

This screen is the glass cockpit (modern instrumentation) display. The indicated air speed is displayed on a vertical scale with a dial containing the IAS in numbers. The true air speed is indicated at the bottom of the vertical scale. The altitude is indicated on a vertical scale on the right side of the moving map with a dial containing the altitude in numbers. The vertical speed is indicated on a vertical scale on the right side of the altitude scale. The G-meter is indicating the acceleration in a white window below the Vertical speed indicator.
Engine RPM, Rotor RPM and manifold pressure are indicated left of the engine data at the left bottom corner of the display.

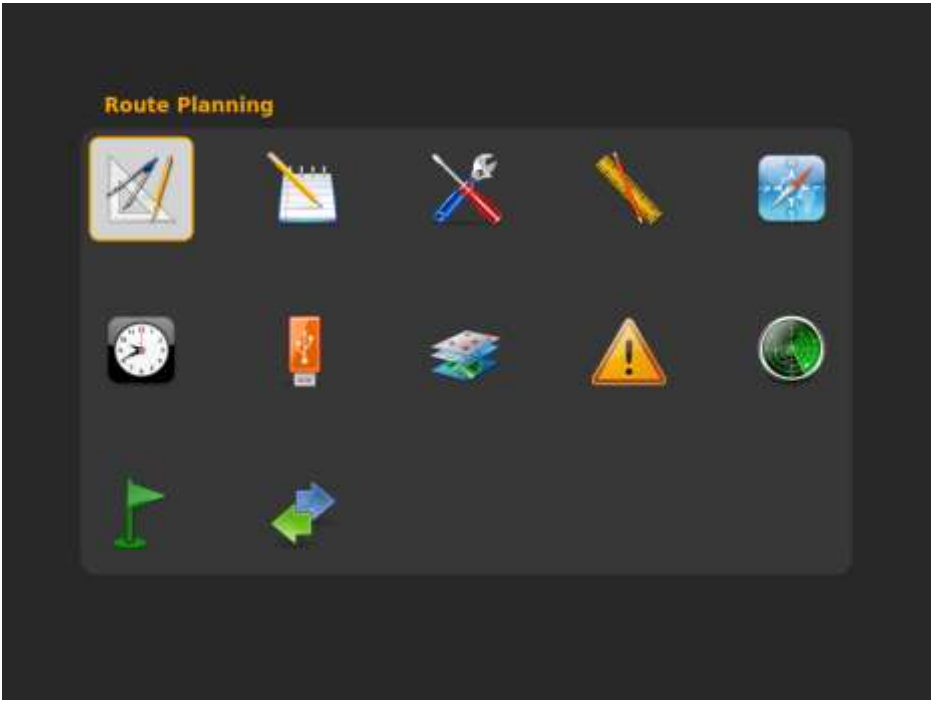


Traffic awareness, ADS-B and Flarm (if installed) will be displayed on the moving map in this display.

Turning the rotating knob 2 will result in zooming in or out in the moving map. Turning the rotating knob 1 will toggle between the 5 main displays.

The fifth main display (the setting screen):

The user can set in this screen the desired personal settings.
Downloads and uploads of data are also activated in this screen.



More information about the operation and the proper use of the unit is found in the separated manual of NESIS.

8 TRANSCEIVER, TRANSPONDER & ELT

8.1 Introduction

The standard configuration does not include transceiver, transponder or ELT. The wiring and circuit breakers for this equipment are partially included in the standard version. These are options to be ordered directly from the gyrocopter manufacturer and will factory installed.

8.2 TRANSCEIVR

It is left up to the operator of the gyrocopter to select the type of transceiver to be installed. Trixy Aviation will deliver the manual of the radio separately, if it is installed in the factory.

8.3 Transponder

It is left up to the operator of the gyrocopter to select the type of transponder to be installed. Trixy Aviation will deliver the manual of the transponder separately, if it is installed in the factory.

8.4 ELT

It is left up to the operator of the gyrocopter to select the desired ELT type to be installed. Trixy Aviation will deliver the manual of the ELT separately, if it is installed in the factory.

9 POWER PLANTS

9.1 Introduction

A 4 stroke engine of the type Rotax 912 ULS or Rotax 914 UL serves as a power plant. These engines are developed and certified for use in ultra-light gyrocopters; however, they are not certified for general aviation. For this reason an engine failure must always be considered and the flight rout must be chosen so that a safe landing is always possible.

Warning: Maintenance work and checks are to be carried out in regular intervals acording to maintenance protocols (e.g. engine oil change every 50 h, sparkplug replacement after 200 h).

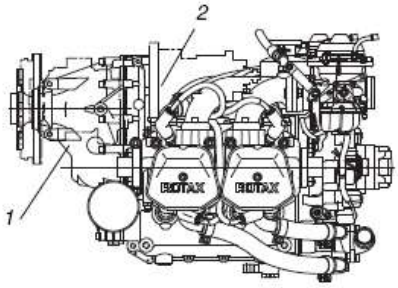
Attention: Flights under icing conditons are prohibited.

Note: Pure water may never be used as engine coolant, only the mandatory mixture with 50% antifreeze (BASF GL48) and 50% distilled water. Air filter K&N Lifetime cotton filter is to be used. It is to be cleaned and oiled or replaced, depending on the condition.

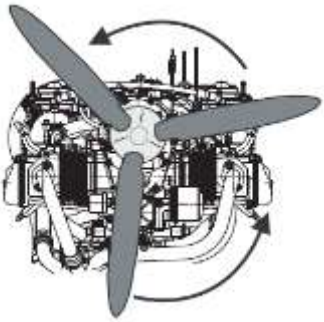
In case of disregard to the maintenance instructions the manufacturer warranties are void!

9.2 Triebwerkansichten

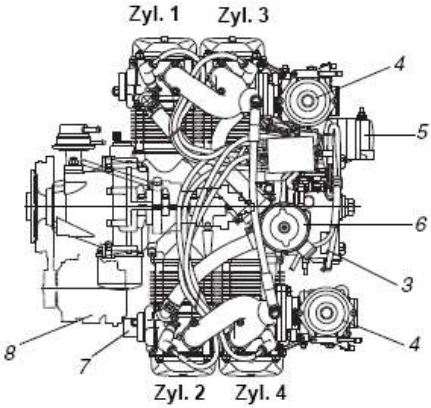
Side view



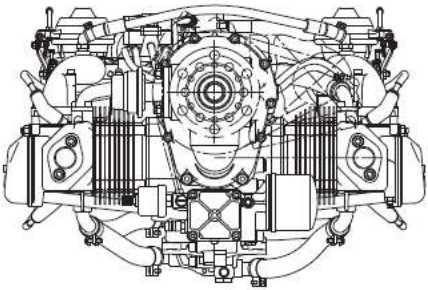
Direction of rotation



Top view



Front view



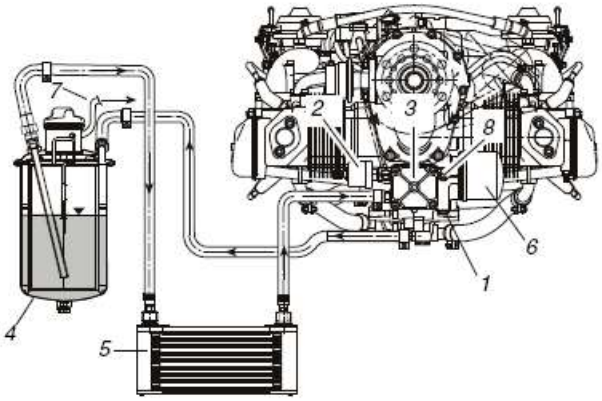
9.3 Power plant

1 Propeller hub
2 Vacuum pump (not used)
3 Engine serial number
4 Carburetors
5 Electric starter
6 Reservoir for coolant
7 Exhaust manifold
8 External general (optional)

9.4 Oil system

Checking the oil is very important:

1. Both ignition circuits turned off
2. Remove the cap of the oil container
3. Turn the engine at the propeller in rotation tirection aproximately 8-10 revolutions (until flushing sound can be heard)
4. The oil level is measured while the gyrocopter is level and should not be lower than the middle of the flat area of the dip-stick. It should not be higher than the top of the flat area.



1 Pressure regulator
2 Oil pressure sensor
3 Oil pump
4 Oil container
5 Oil radiator
6 Oil filter
7 Vent hose
8 Oil temperature sensor

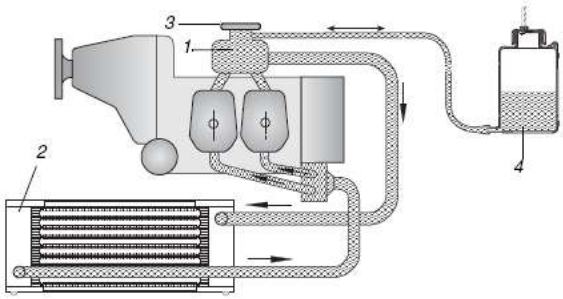
Warning: both ignition circuits must be turned off before the engine is turned by hand to check the oil level. There is a risk of severe injury and/or death if this is ignored.

Attention: Low oil level in the system may lead to damage and engine failure during flight.

Note: In case of engine damage due to low oil level, all manufacturer warranties are void!

9.5 Cooling system

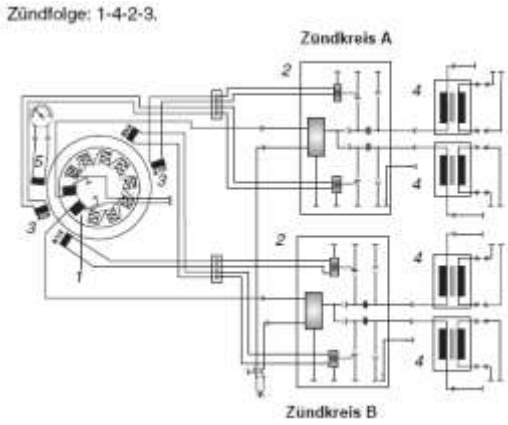
To check the level of the engine coolant it is important to not only check the reservoir, but also every now and then to check the level of the expansion container (4). The radiator (2) must be checked for clean surfaces and no leaks.



Attention: The cap (3) of the expansion/reservoir container (1) may only be opened when the engine is cold! Danger of scolding!

9.6 Ignition system

The two independent magnetos on the generator stator (1) each supply one of the 2 ignition circuits. The energy is saved in condensers in the electrical module (2). At the time of ignition, 2 of the 4 transducers (3) initiate the discharge of the condensers via the main coil of the dual ignition transformers (4). The sensor (5) is designated for the RPM signal.



9.7 Fuel system

See section 6.9 for the fuel system.

9.8 Power plant maintenance

All checks are to be performed according to the maintenance manual of ROTAX (newest revision / issue).
Prior to every flight an oil level, coolant level, and ignition wiring check must be done by the pilot in command.

Warning: The disregard of this information may lead to injury or death! Only qualified technicians (authorized by ROTAX) which have been trained on this engine are permitted to undertake repairs and maintenance work.

1. In extreme climates and in case of prolonged standstill the following is suggested to avoid corrosion of valve guides:
2. The engine must be running until all temperatures are stable for 5 minutes (oil temperature between 50° C and 70° C)
3. Shut the engine down and let it cool off
4. Change the oil
5. Let engine run with increased idle speed and with the air filters removed squirt approx. 30 cm^3 of preservation oil into the carburetor then shut the engine down.
6. Drain the carburetor floater chamber and wet all carburetor joints with engine oil.
7. When engine is cold, close off all openings – exhaust pipe, ventilation pipe, and air filter against dirt and moist air.

10 Propeller

The ***G 4-2*** are factory equiped with a high performance propeller (DUC Windspoon) which may be adjusted on the ground or an in flight adjustable propeller (Neuform CL3-V-70 IP R2).

Warning: it is recommended to read and follow the instructions given in the manuals of the propeller and the engine!

Note: In case of mishandling or incorrect operation of the propeller, the warranties of the propeller and/or engine will be void!

11 HANDLING, MAINTENANCE AND CARE

This section contains recommendations of the manufacturer about the correct handling of the gyrocopter on the ground and about maintenance and care which must be performed to retain the performance and reliability of the gyrocopter. The regular care and cleanliness of the powertrain, propeller, rotor system, undercarriage, control systems and cowling is the first prerequisite for operating safety. It is to be performed in adapted intervals depending on weather conditions and use.
To avoid the gyrocopter from getting dusty, it is recommended to cover it with the optional tarp. If no hangar is available, it is recommended to store the gyrocopter in the optional trailer. Openings to the engine, fuel system and Pitot tube should be closed off after flights (insects, birds and such).
Grime on the gyrocopter may be removed by clean water and eventually with cleaning additives.

Attention: Do not use fuel or solvents under no condition to clean the glass. The used materials (PMMA and Polycarbonate) will be RUINED if this is used!

The parking place of the gyrocopter should be dry and protected from sunlight and wind. If the gyrocopter is constantly stored outdoors and is exposed to sun, wind and rain it will age and corrode quickly.

11.1 Maintenance instructions

All mandatory inspections (e.g. annual inspections) required by low in the country where the gyrocopter is registered must be done and documented in time. All other checks and maintenance works are to be performed as instructed in the maintenance manual by authorized aviation service shops.

Note: If the maintenance instructions are not fulfilled, all manufacturer warranties are void!

11.1.1 Frame, propeller and rotor

At 500 hours, the frame, propeller and rotor must be inspected by the manufacturer or an authorized workshop. The necessary maintenance work through the course of the TBO is non-destructive and will not necessarily lead to exchange of the parts if no damages are found.

11.1.2 Engine

The power plant must be maintained with the procedures and intervals as written in the engine's manual. A complete overhaul (TBO) must be carried out at 2000 hours (at the latest) as instructed by the engine's manufacturer.

11.1.3 Daily check

The daily check must be done prior to every flight (or the first flight of the day if several flights are made) as instructed in section 3.3.

11.1.4 25 hour check

As instructed by the engine's and propeller's manufacturers, a check of these parts is to be carried out after every 25 hours.
To keep the gyrocopter manufacturer's warranty, the maintenance must be done by an authorized workshop and be loged into the maintenance manual.

11.1.5 50 hour check

As instructed by the engine manufacturer, a check of the powerplant is to be carried out every 50 hours.
To keep the gyrocopter manufacturer's warranty, the maintenance must be done by an authorized workshop and be loged into the maintenance manual.

11.1.6 100 hour check

As instructed by the engine's and propeller's manufacturers, a check of these parts is to be carried out every 100 hours.
To keep the gyrocopter manufacturer's warranty, the maintenance must be done by an authorized workshop and be loged into the maintenance manual.

11.2 Repairs

The operator of the gyrocopter must insure that only original parts are exchanged and documented by an authorized work shop after consulting the manufacturer. Only original spare parts may be used.
Malfunctions, which may have been caused by weaknesses in construction, are to be reported to the manufacturer by the enclosed form. No welding on the frame is permitted without authorization of the manufacturer.

Note: Repairs may onle be carried out by authorized personell by the manufacturer. Only original spare parts may be used. Exchanging parts require the written consent of the manufacturer.

11.3 Ground handling and road transportation

Experience has shown that aircrafts are generally exposed to higher stress on the ground than in the air. Through, this higher stress on the ground it is more likely to cause severe damage to the aircraft and reduce flight safety. This is especially the case with lightly built ULs. The gyrocopter's frame is exposed to extreme stress by high G-forces through hard landings and taxying on uneven terrain and pot holes. For this reason, unnecessary road transport should be avoided.
For transportation, drain the fuel tanks and wrap the entire gyrocopter (e.g. with bubble wrap) to keep it safe. The rotor blades must be packaged with special care because the smallest damage alredy forces the replacement of the entire rotor system.
In case of road transport on an open trailer the rotor system must be removed as instructed in section 3.21 and all parts must be secured to the trailer by belts.

Attention: in case of transport on an open trailer the rotor system must be removed from the rotor head. Follow the instructions in section 3.21 (how to handle the rotor system). If the rotor system is mishandled it may be damaged irreparably.

The gyrocopter manufacturer also offers enclosed trailers in which the rotor may be left installed during the transportation. Such trailers are called mobile hangar and they may also be equipped as a caravan.

11.4 Maintenance and care

The regular care and cleaning the power plant, propeller, rotor system, control systems and frame are important for flight safety. This must be executed in intervals depending on weather and use. The rotor system is to be cleaned after every flight. Grime on the rotor may be removed by clear water and eventually with cleaning additives. To do so, let grime soak and then flush with plenty of clear water.

Special care must be taken when cleaning glass. Do not use fuel, solvents or insect remover to clean glass surfaces under any circumstances. The unbreakable material will develop small cracks and will be ruined.

After cleaning with water, make sure all wet parts can dry easily.

11.5 Winter operation

The cooling system for the cylinder heads of the engine is filled with a water/anti-freeze mixture which will not freeze in temperatures as low as -18°C. Prior to temperatures reaching freezing levels the anti-freeze mixture must be analyzed to confirm the freezing level. If the temperature drops below the indicated value, the anti-freeze mixture must either be drained, or exchanged with pure anti-freeze to guarantee that the liquid will not freeze. Due to aging and the dropping anti-corrosive properties, the coolant must be exchanged every 2 years. Further information may be found in the engine's manual.

During winter operation the operating temperatures for the cylinder heads are most likely not reached. This can be compensated for by covering a part of the radiator.

The oil temperature, in turn, will most probably reach the required 80°C because a thermostat is built into the oil circuit.

The Bowden cables are to be checked for icing and proper daily wetting with oil.

11.6 Operation with closed cabin and cabin heat

G 4-2 can be equipped with the optional removable cabin glass. Cabin heat is also available as an option.

It is indicated that the cabin glass must be mounted and secured properly when it is installed on the ground.

The cabin heating system consists of a heat exchanger and a fan. Engine coolant be is used to heat the cabin when allowed to path through the heat exchanger which is installed under the pilot seat. A ball valve is installed on the coolant plumbing in the engine compartment to shut off the flow to the heat exchanger in the cabin, when the heating system is not used (i.e. summer operations).

12 APENDIX

12.1 Introduction

This section contains explanations related to the safe use of installed auxiliary equipment and the use of the gyrocopter.

12.2 Minimum equipment

The legal documents of the gyrocopter (Airworthiness certificate, registration, radio license,…..) must always be on board.
Personal pilot equipment may include headset with microphone, head cover (during open operation) and sun glasses.
Proper clothing during winter operation with open cabin or closed cabin without cabin heat must be considered.
It is recommended to wear an apropriate helmet during operation with open cabin. This counts for the pilot and for the passenger/co-pilot.

The gyrocopter equipment includes:

- Safety belts (2 x 4- point belt systems)
- Type label
- Data label and checklist (these must be mounted clearly visible)

To be carried on board:

- Flight manual
- Registration certificate
- Proof or insurance
- Noise certificate
- Flight log book
- Weight and balance report (valid for 48 months)
- Avionic-inspection protocol (valid for 12 / 24 months)
- Airworthiness certificate

Minimum instrumentation required by law in Germany:

- 1 airspeed indicator
- 1 altimeter
- 1 compass
- Engine instruments
- 1 rotor RPM gauge
- 1 fuel gauge

G 4-2 is equipped with a mini glass cockpit (EMSIS) or a glass cockpit (NESIS II) in the standard configuration. It contains the minimum required instrumentation by law and much more. In agreement with the registration office the gyrocopter is additionally equipped with a mechanical airspeed indicator, an altimeter and a magnetic compass.

12.3 Possible optional equipment

See the list of accessories on the website of Trixy Aviation (www.trixyaviation.com) for both models of the series G 4-2.

12.4 List of supplements

Date	No.	Description of supplement

12.5 Incident, accident and technical defect report

Type of aircraft: Serial no.:
Year Model: Call sign:
Engine no.: Manufacturer:
Operator:
Hours flown until damage, engine: cabin:
Pilot experience on type (hours):
Description of the damage:

Description of the incident, accident or technical defect:

Reported by:
Name:
Address:

Phone/Fax:
Date: Signature:

Please send to:
Trixy Aviation GmbH
Eschbuehel 10 F
A-6850 Dornbirn
Austria
info@trixyaviation.com

13 EMERGENCY PROCEDURES

13.1 Introduction

This section contains checklists and procedures to overcome emergency situations.
Emergencies due to failure of the gyrocopter or the power plant are extremely seldom, as long as a careful pre-flight-inspection and proper maintenance are undertaken. In case an emergency still arises, the fundamental guidelines stated in this section should be applied to overcome the emergency.

As alredy stated earlyer in section 1.2 UL-power plants are not certified to aeronautical standards due to the high costs. Experience has shown that for this reason, above all, power plant defects may arise. Always be alerted! Always fly so that an outside landing is possible at all times!

Warning: This manual is no substitute for proper theoretical or practical instruction for the operation of this gyrocopter!

Warning: The disregard to the instructions given in this manual may have fatal or life threatening consequences!

13.2 Engine failure

The following is recommended in case of engine failure:

During start, prior to take-off: Abort take-off procedure, hold direction, apply brakes; while braking the control stick should remain pulled all the way back to assist in the brakeing process. The stick must be pusched forward, if the rotor is rotating at or below 180 RPM.

During start, after take-off: land straight ahead.

80 m after take-off: If possible, land straight ahead, otherwise fly a flat turn and, according to wind situation, land in the opposite direction.

During flight with altitude above 100 m: look for suitable emergency landing field and prepare for landing, consider the wind direction and speed, land against the wind or up-hill.

Tree landing or high vegetation: Consider top of vagatation as runway, flare and land with minimal speed. During initial contact with vegetation, hold control stick very tight.

Engine rough / loss or power: Consider possible carburator icing. Change altitude to a lavel where no icing conditions exist. Consider fuel pump failiure. If required, perform safety outside landing.

Attention: Plan safe flight rout and practice the emergency procedures and outside landings until they are safely mastered. Practice flying, engine out landings and get familiar with glide charcteristcs of the gyrocopter. This is the best way to avoid being overtaken by a possibly arising situation.

13.3 Engine re-start during flight

Proceed start-up as described in section 3.6 with 30 seconds warm-up phase until full power can be demanded from the engine.

13.4 Smoke and Fire

The following procedures are recommended, in case of engine smoke or fire:

Fire at the engine on the ground (no direct fire): disembark the gyrocopter quickly but safely.

Fire at the engine during start (no direct fire): Fly flat turns, land as practical (even if this was against the wind).

Fire at the engine during flight (no direct fire): Emergency landing, disembark the gyrocopter quickly.

Im Flug, höher als 100 m: Emergency landing, leave gyrocopter quickly.

13.5 Gliding

The speed for best gliding is 100 km/h.
Glide ratio with engine idle 1:4
Glide ratio with engine off 1:3

13.6 Emergency landing

a) Emergency landing:
An emergency landing is when an emergency situation occurs during flight which makes an immediate landing necessary (e.g. Fire on board, heavy damage or malfunction of the gyrocopter, engine failure, life threatening condition of the pilot or passenger).

b) Safety landing:
A safety landing is when the pilot decides to land to avoid an impending emergency situation, which has not yet occured (e.g. unexpectet meteorological conditions which do not permit a continued flight, unusual behavior of the engine or the pilot got sick).

c) Landing with defective undercarriage or flat tire:
Regular approach. Land with high angle of attack and minimum speed, slow the gyrocopter down with the rotor and hold direction with the rudder. After successful landing the engine is to be shut down immediately putting the switches for “MAG1“, “MAG2“ and “master switch” in OFF position.

d) Landing with engine power:
Look for emergency landing field and prepare landing accordingly. Pay attention to wind direction and speed and if possible land against the wind and up-hill.

e) Landing without engine power:
Look for emergency landing field and prepare landing accordingly. Pay attention to wind direction and speed and if possible land against the wind and up-hill.

13.7 Rescue system:
Because the gyrocopter is equipped with a rotor system which is constantly in autorotation during flight, no further rescue system is installed. For this reason it is important to look after the entire rotor system including the rotor head with special care.

13.8 Miscellaneous emergency procedures

13.8.1 Loss of manouverability:
Try to reach a large landing field by using the possibly remaining rudder and changing altitude with engine power.
Fly wide and flat turns.
Land against the wind direction, if possible.

13.8.2 Loss of maneuverability around pitch axis:
The air speed to maintain horizontal flight will vary depending on the CG position.
Steer course with side rudder pedals.
Control speed and altitude with engine power.

13.8.3 Loss of maneuverability of yaw axis:

Control course and speed by pitching and rolling.
Control altitude with engine power.

13.8.4 Loss of maneuverability of banking:

Hold course with side rudders, land straight ahead.
Control altitude with engine power.

13.8.5 GEN-light:

The normal electric circuit voltage is around 13.2 V. The glass cockpit NESIS II displays a warning once the circuit voltage drops below 12 V. The display of the glass cockpit darkens at a voltage around 10 V. However, the unit continues to operate with a voltage as low as 6.5 V. The generator light lamp is used to check the generator. If the LED stays on constantly during flight, the battery is no longer charged. If this occurs, all electrical loads beside the glass cockpit, the transceiver and the transponder are to be turned off:

1. All external units connected to the board net OFF
2. Landing light OFF
3. Navigation light OFF
4. Windshield fan OFF
5. Cabin heat fan OFF

If the voltage continues to drop down, the pilot must plan a normal landing in the closest airfield and must be ready for a safety landing, if he cannot reach an air field. At a voltage of 12 V or lower, the pilot must consider a safety landing.

A sudden drop of the electrical circuit will cause all electronic units in the panel to drop off. In such a case, the pilot must initiate a safety landing or an emergency landing. The pilot should reset all circuit breakers in the panel. If this solves the problem, the pilot must plan a normal landing in the closest air field. The pilot must keep an eye on the voltage and remain alert for a safety or emergency landing.
A drop of the electrical circuit should not cause the engine type Rotax 912 ULS to quit. However the engines of type Rotax 914 UL and Trixy 912 TI are equipped with electrical fuel pumps. A breakage of the board net will cause these those engines to quit.

The transceivers of type Funkwerk ATR500 or ATR833 indicate also low voltage. A blinking “B” in the upper left display indicates battery voltage lower than 10.5 V.

Warningg: A fault in the board circuit of Type G 4-2 equipped with Rotax 914 UL or Trixy 912 TI may cause the engine to quit. Those 2 engine types are equipped with electrical fuel pumps and the shortage of electrical power supply leads to fuel starvation within seconds.

13.8.6 Engine instruments /oil pressure / CHT / oil temperature:

If the indicator is outside of the green range of the instruments, the instrument must be monitored closely. When the indicator leaves the yellow range of the instrument, a safety landing should be performed, otherwise the engine may fail. A safety landing should also be made if the oil pressure drops to 0.

13.8.7 Rotor icing:

If more engine power is required to keep the altitude during horizontal flight, ice buildup on the rotor may be the cause. This can go so far that horizontal flight, even with full engine power, is no longer possible. In this case, an altitude with warmer, dry air (could be higher) must be considered or a safety landing must be performed.

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